RUSALCA 2010 - BERING STRAIT MOORING CRUISE REPORT

Russian Research Vessel Professor Khromov (also called Spirit of Enderby)

Nome, 31st July 2010 – Nome, 11th August 2010

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Funding from NOAA RUSALCA Program and NSF Arctic Observing Network Program ARC-0855748

(Photo by Aleksey Ostrovskiy)

(Photo by R Woodgate)

Expedition Leader: *Vladimir Bakhmutov, State Research Navigational Hydrographical Institute, Russia.*
Science Coordinators: *Kathleen Crane, NOAA, USA; Mikhail Zhdanov, Group Alliance, Russia (RF) and Aleksey Ostrovsky, Group Alliance, RF.*
Chief Scientist: *Rebecca Woodgate, University of Washington (UW), USA.*
Science Liaison at Sea: *Kevin Wood, NOAA/UW, USA.*

As part of the joint US-Russian RUSALCA (Russian US Long-term Census of the Arctic Ocean) Program, a team of US and Russian scientists undertook a ca.10-day oceanographic cruise in July/August 2010 on board the Russian vessel 'Khromov', operated by Heritage Expeditions (under the name of Spirit of Enderby).

SUMMARY:

The major objective of the cruise was mooring work in the Bering Strait region, i.e., the recovery and redeployment of 8 moorings, a joint project by the University of Washington (UW), the University of Alaska, Fairbanks (UAF), and the Arctic and Antarctic Research Institute (AARI). The US portion of the mooring recoveries is supported by a NOAA-RUSALCA grant (PIs: Woodgate, Weingartner, Whitledge and Lindsay). The US portion of the mooring deployments is supported by an NSF-OPP AON (Arctic Observing Network) grant (PIs: Woodgate, Weingartner, Whitledge and Lindsay). The moorings measure water velocity, temperature, salinity, ice motion, ice thickness (crudely) and some bio-optics.

The secondary objectives of the cruise were station work, primarily CTD work with sampling for nutrients, chlorophyll, DON (Dissolved organic nitrogen), DIC (Dissolved Inorganic Carbon) and phytoplankton. In addition, some primary productivity casts were made. Net tows for zooplankton were also taken on various sections of the cruise. Also, marine mammal observations were made from the bridge by dedicated observers.

Weather conditions were excellent for the majority of the cruise. The mooring operations went extremely smoothly, leaving time for completing 6 CTD lines, as described below:

BS – the main Bering Strait line, run at the start and at the end of the cruise. This line has been occupied by past RUSALCA mooring cruises, and in full crosses both channels of the Bering Strait.

AL – another previously-run line, just north of the Strait, running from the Russian coast, through the mooring site A3, to where the main channel of the strait shallows on the eastern (US) side.

CS - another cross strait line, running from Cape Serdtes Kamen (RF) to Point Hope (US).

The CS line gave strong evidence of the presence of the Siberian Coastal Current along the Russian coast, and thus, since the weather remained workable, three additional lines were occupied.

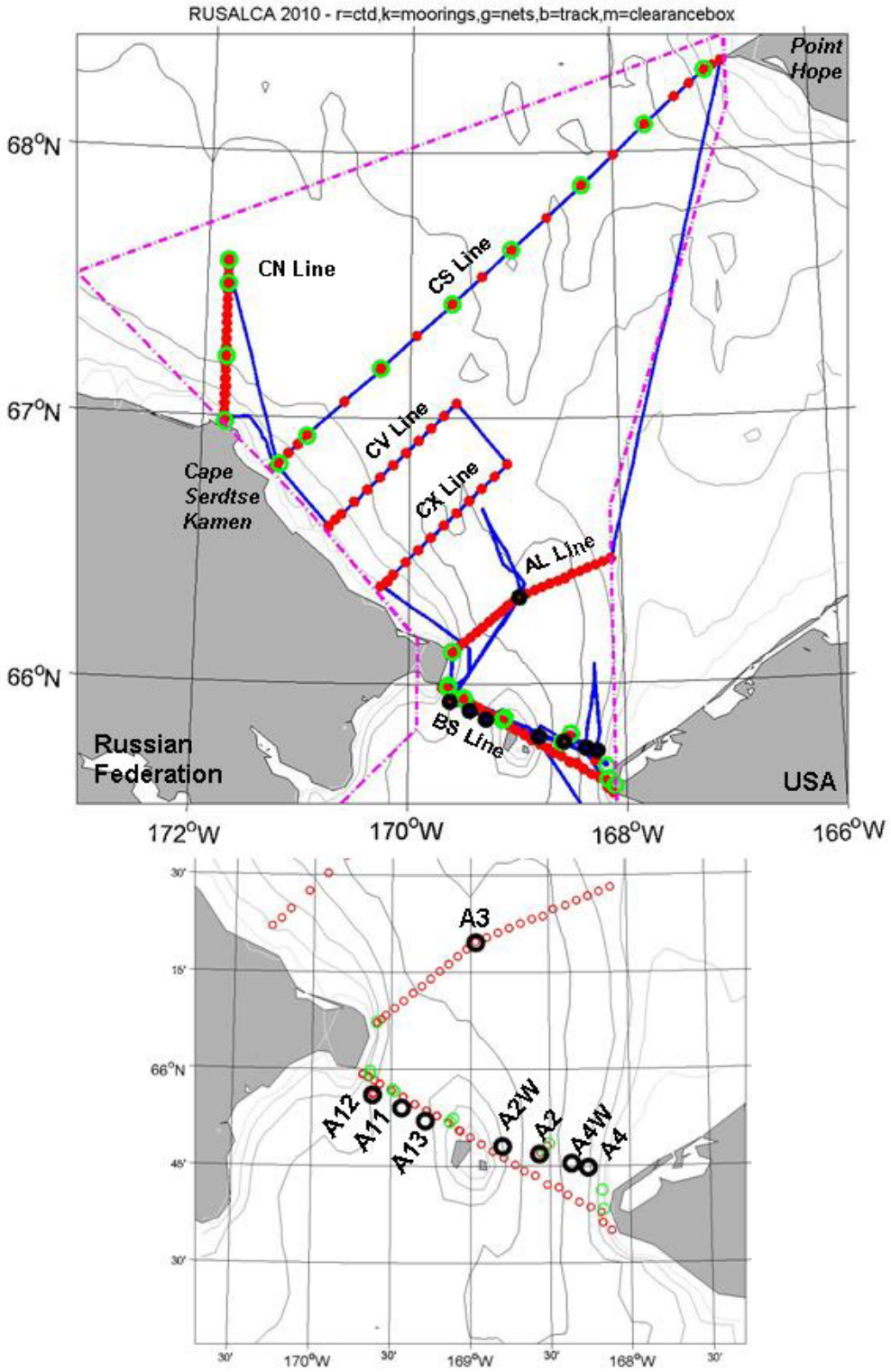
CN – a line run north from Cape Netten (RF)

CV and CX - two lines run ~ perpendicular to the Russian coast, between the CS and AL line.

Finally, half of the BS line was rerun at the end of the cruise, but only in the Russian channel.

International links: Maintaining the time-series measurements in Bering is important to several national and international programs, e.g., the Arctic Observing Network (AON) started as part of the International Polar Year (IPY) effort; NSF's Freshwater Initiative (FWI) and Arctic Model Intercomparison Project (AOMIP), and the international Arctic SubArctic Ocean Fluxes (ASOF) program. The mooring work also supports regional studies in the area, by providing key boundary conditions for the Chukchi Shelf/Beaufort Sea region; a measure of integrated change in the Bering Sea, and an indicator of the role of Pacific Waters in the Arctic Ocean. Furthermore, the Bering Strait inflow may play a role in Arctic Ocean ice retreat [*Woodgate et al.*, 2010] and variability (especially in the freshwater flux) is considered important for the Atlantic overturning circulation and possibly world climate [*Woodgate et al.*, 2005].

RUSALCA 2010 CRUISE MAP: *Ship-track in blue, Mooring sites in black, CTD stations in red, and Zooplankton nets in green. Mauve dashed lines indicate area with working permission. Depth contours are every 10m from the International Bathymetric Chart of the Arctic Ocean [Jakobsson et al., 2000].*



RUSALCA 2010 SCIENCE PARTICIPANTS

1.	Kathleen Crane (F)	NOAA	*Program Manager, NOAA;*
2.	Vladimir Bakhmutov (M)	SRNHI	*Expedition Leader*
3.	Aleksey Ostrovskiy (M)	GA	*Liaison and translator*
4.	Rebecca Woodgate (F)	UW	*US Chief Scientist*
5.	Kevin Wood (M)	NOAA/UW	*Science Liaison*
6.	Jim Johnson (M)	UW	*UW Mooring lead*
7.	Marla Stone (F)	NPS	*UAF Mooring lead*
8.	Brian Svabik (M)	UAF	*UAF Moorings*
9.	Elena Bondareva (F)	AARI	*AARI Moorings*
10.	Steve Hartz (M)	UAF	*CTD lead*
11.	Chase Stoudt (M)	UAF	*graduate student, Moorings and CTD*
12.	Jonathan Whitefield (M)	UAF	*graduate student, Moorings and CTD*
13.	Dan Naber (M)	UAF	*moored sampler, water sampling, mooring assistance*
14.	Mike Kong (M)	UAF	*graduate student, water sampling, mooring assistance*
15.	Valentina Sergeeva (F)	SIO	*Phytoplankton*
16.	Konstantin Soloviev (M)	SIO	*Phytoplankton*
17.	Elizaveta Ershova (F)	UAF	*Zooplankton Nets*
18.	Kate Stafford (F)	UW	*Marine Mammal & moored acoustic recorder*
19.	Carter Esch (F)	WHOI	*Marine Mammal & moored acoustic recorder*
20.	Alexey Sherbinen (M)	FERHRI	*Technical Support*
21.	Sergei Yarosh (M)	FERHRI	*Technical Support*
22.	Iouri Pashenko (M)	FERHRI	*Technical Support*
23.	Alexander Murayvev (M)	FERHRI	*Technical Support*

NOAA – National Ocean Atmosphere Administration, US
State R N. Hydro – State Research Navigational Hydrographic Institute, RF
GA – Group Alliance, RF
UW – University of Washington., US
NPS – Naval Postgraduate School, US
UAF – University of Alaska, Fairbanks, US
AARI – Arctic and Antarctic Research Institute, RF
SIO – Shirshov Institute of Oceanology, RF
WHOI – Woods Hole Oceanographic Institute, US
FERHRI - Far Eastern Regional Hydrometeorological Research Institute

RUSALCA 2010 CRUISE SCHEDULE

Monday 26th July 2010	*UW mooring team (Rebecca, Jim) arrive Nome*
Tuesday 27th July 2010	*Instrument prep (start all UW instruments) in Nome*
Wednesday 28th July 2010	*Build ADCPs, build ISCATS (Chase arrive pm, Marla evening)*
Thursday 29th July 2010	*Restuff container (Dan&Mike arrive pm, Carter&Kate evening)*
Friday 30th July 2010	*Ship docks ~ noon, Onload pm till 8pm*
Saturday 31th July 2010	*Start all UAF mooring gear, Russians arrive evening, sail 10pm* *Transit to A2*
Sunday 1st August 2010	*On site A2 at 10am, recover A2-09* *On site A4W at 12pm, recover A4W-09* *On site A4 at 130pm, recover A4-09* *On site A2W at 330pm, recover A2W-09 (required 2nd release)* *Run 6 nets on Bering Strait section during night*
Monday 2nd August 2010	*On site A13 at 9am, recover A13-09* *On site A11 at 10:30am, recover A11-09* *On site A12 at 1pm, recover A12-09* *On site A3 at 4:30pm, recover A3-09* *Drift during night*
Tuesday 3rd August 2010	*On site A3 at 9am, deploy A3-10 (start 10am)* *On site A12 at 1:30pm, deploy A12-10* *On site A11 at 2:10pm, deploy A11-10* *On site A13 at 4pm, deploy A13-10* *On site A2W at 5:45pm, deploy A2W-10* *On site A4W at 7:30pm, deploy A4W-10* *Drift during night*
Wednesday 4th August 2010	*On site A4 at 915am, deploy A4-10* *On site A2 at 11am, deploy A2* *Primary Productivity and Net at A2* *Run to US side of BS line* *Run BS line from US to Russia – start 4:30pm* *with 4 nets (BS1,3,8 and 22)*
Thursday 5th August 2010	*Finish BS line 11am **(casts 3-28)*** *Moored ISUS cal and Primary Productivity casts at A12* *Transit to Russian side of AL line* *Run AL line from Russia to US – start 3pm* *Net at AL1*
Friday 6th August 2010	*Finish AL line 6am **(casts 32-56)*** *Transit to US side of CS line* *Run CS line from US to Russia – start 4:30pm* *Nets at stations (CS1,4,6,8,10,12,14,17)*
Saturday 7th August 2010	*Primary Productivity Cast at CS6* *Finish CS line (adding 0.5 station) 5pm **(casts 57-78)*** *Transit north in ice (polar bears and walrus) to CN line* *Run CN line northward – start 7:30pm* *Nets at stations (CN1,9,18,21)*

Sunday 8th August 2010 *Primary Productivity Cast at CN21*
*Finish CN line 10:30am **(casts 79-102)***
Transit south to CV line
Run CV line from Russia to central Chukchi – start 4pm

Monday 9th August 2010 *Finish CV line 1:30am **(casts 103-114)***
Transit south to CX line
Run CX line from central Chukchi to Russia – start 4am
*Finish CX line 1pm **(casts 115-126)***
Transit south to BS line
Run BS line from Russian to Diomedes – start 4:30pm
*Break line at BS9 to turn for Nome **(casts 127-137)***

Tuesday 10th August 2010 *Arrive off Nome 11:30am*
Anchor off Nome waiting for scheduled dock on 11th

Wednesday 11th August 2010 *Tie up at Nome outer cell 7:30am*
Refuel ship. Start offload 12:45, crane work complete 13:30.
Clear from ship ~ 4pm

Days at sea (away from Nome): 9.5 days at sea
Moorings recovered/ redeployed: 8
CTD casts: 137
Primary Productivity stations: 4
Zooplankton Nets: 23

SCIENCE COMPONENTS OF CRUISE

The cruise comprised of the following science components:

- Mooring operations

Mooring operations were a joint UW, UAF, AARI operation, assisted by other cruise members.

- CTD operations

CTD operations were led by the UAF team, assisted by other cruise members.

-Water sampling from the CTD rosette

Water samples were taken for various components, as per the following table.

Line	Nutrients	Chl	DIC	DON	Phyto	PP	ZNet	O18
						A2	5 in strait	-
BS	All	All	Half	Half	Many	A12	A2+4	-
AL	All	All	-	-	Some		AL1	-
CS	All	All	-	Half	Some	CS6	8	CS0.5
CN	All	All	-	-	Some	CN21	4	-
CV	All	All	-	-	Some		-	-
CX	All	All	-	-	-		-	-
BS(Rhalf)	All	-	-	-	-		-	-

Nutrients, Chlorophyll (Chl), Dissolved Inorganic Carbon (DIC), Dissolved Organic Nitrogen (DON), and Primary productivity (PP) were sampled by the UAF group.

Phytoplankton (Phyto) samples were taken by the SIO group

On one cast (CS0.5) some opportunistic water samples were for delta O18 analysis by UW.

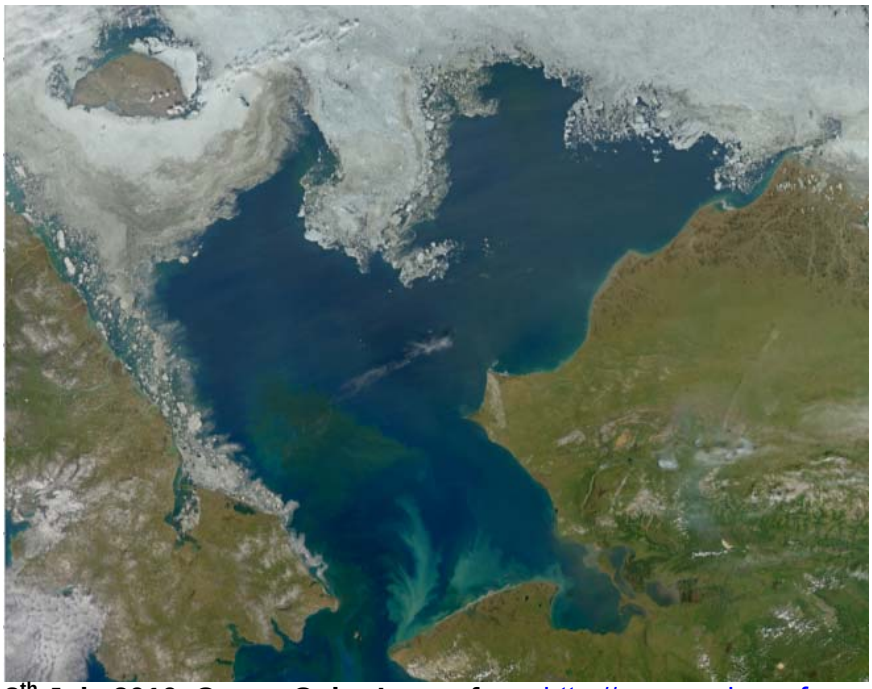
- Zooplankton Net Tows (ZNet)

Zooplankton Net Tows were taken both independently in the strait during the nights of between mooring operations and during the CTD phase of the cruise. This effort was led from UAF with assistance from SIO.

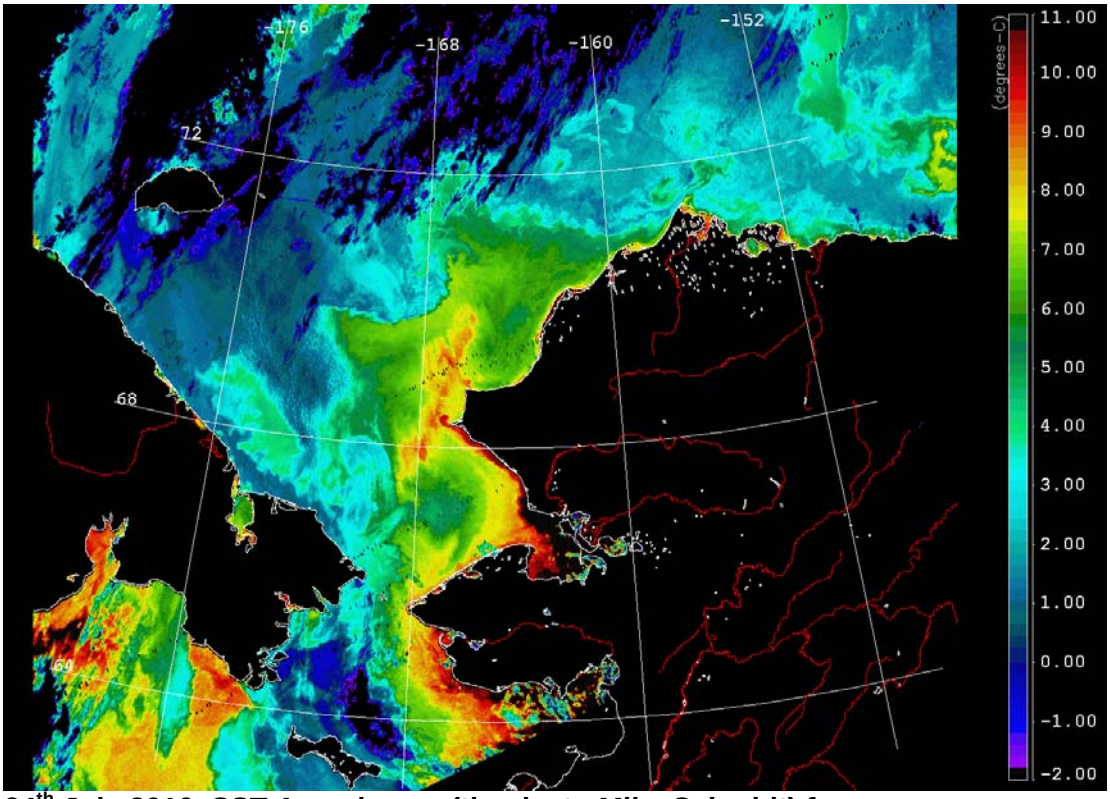
- Whale Observations (including acoustic instruments on the moorings)

UW and WHOI whale observers on the ship took observations of marine mammal and birds and were responsible for the moored acoustic whale recorders.

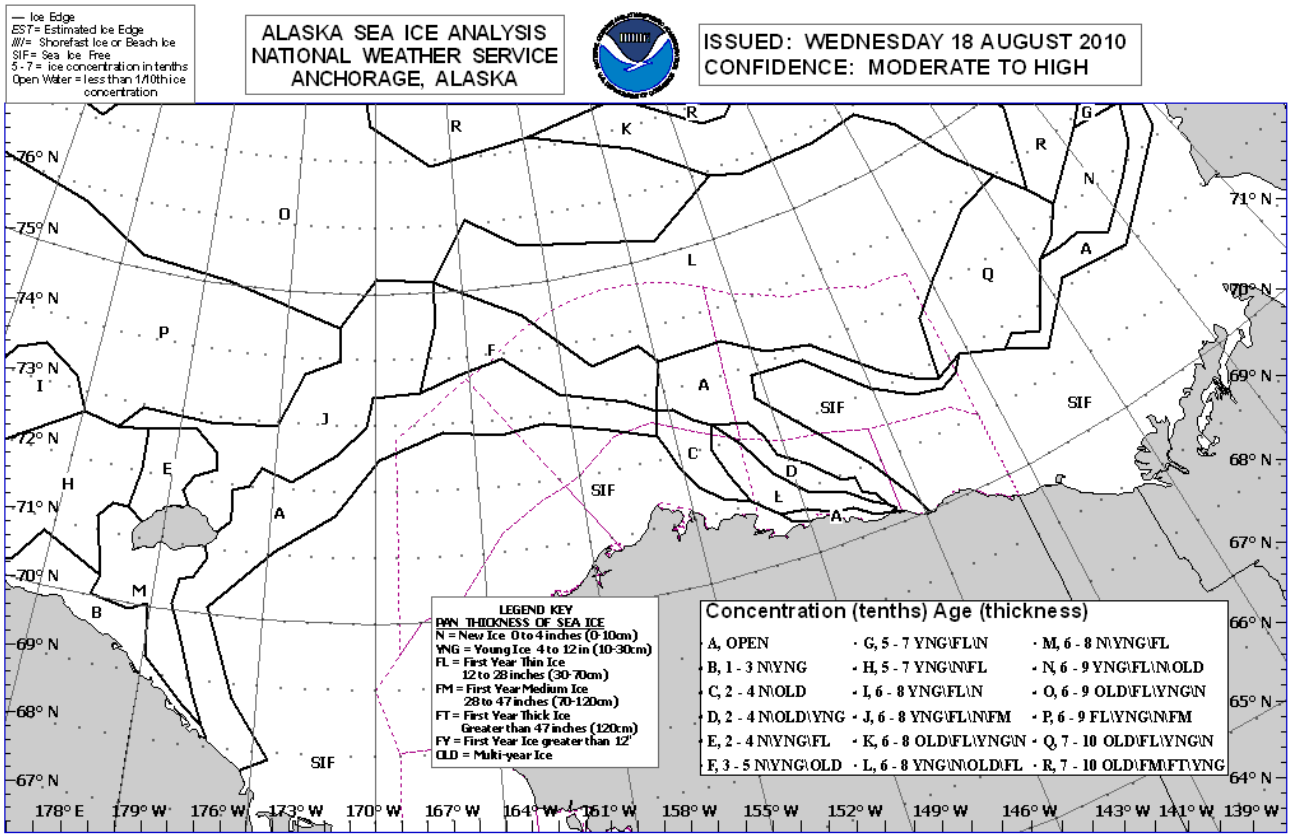
RUSALCA 2010 SATELLITE IMAGES



8th July 2010 Ocean Color Image from http://oceancolor.gsfc.nasa.gov/ (found by Bill Crawford)



24th July 2010 SST Aqua image (thanks to Mike Schmidt) from http://mather.sfos.uaf.edu/~mschmidt/ak_chukchi_sea_2010/A2010205230000_AQUA_LAC_sub1_sst_map.png



http://pafc.arh.noaa.gov/ice.php?img=ice

MOORING OPERATIONS (Woodgate, Johnson, Stone, Svabik, Bondareva)

Background: The moorings serviced on this cruise are part of a multi-year time-series (started in 1990) of measurements of the flow through the Bering Strait. This flow acts as a drain for the Bering Sea shelf, dominates the Chukchi Sea, influences the Arctic Ocean, and can be traced across the Arctic Ocean to the Fram Strait and beyond. The long-term monitoring of the inflow into the Arctic Ocean via the Bering Strait is important for understanding climatic change both locally and in the Arctic. Data from 2001 to 2004 and 2007 suggest that heat and freshwater fluxes are increasing through the strait [*Woodgate et al.*, 2006; *Woodgate et al.*, 2010]. The work completed this summer should tell us if this is a continuing trend.

An overview of the Bering Strait mooring work (including access to mooring and CTD data) is available at http://psc.apl.washington.edu/BeringStrait.html.

Eight moorings were recovered on this cruise. These moorings (three in Russian waters – A11-09, A12-09, A13-09; five in US waters – A2W-09, A2-09, A4W-09, A4-09, A3-09) were deployed in another joint US-Russian cruise supported by the NOAA RUSALCA (Russian-American Long-term Census of the Arctic, http://www.arctic.noaa.gov/aro/russian-american/) program.

Eight moorings were deployed on this cruise under funding from NSF-AON (Arctic Observing Network) (PIs: Woodgate, Weingartner, Whitledge, Lindsay, ARC-0855748) with ship-time and logistical support from RUSALCA-NOAA. These moorings (three in Russian waters – A11-10, A12-10, A13-10; five in US waters – A2W-10, A2-10, A4W-10, A4-10, A3-10) are almost entirely direct replacements of the recoveries, but with some added instrumentation.

This is the 4th deployment year of the highest resolution array ever placed in the Bering Strait (see map above). Three moorings were deployed across the western (Russian) channel of the strait (from west to east - A12, A11, A13). Four moorings were deployed across the eastern (US) channel of the strait (from west to east - A2W, A2, A4W, A4). A final 8th mooring (A3) was deployed ca. 35 nm north of the strait at a site proposed as a "climate" site, hypothesized to measure a useful average of the flow through both channels [*Woodgate et al.*, 2007]. Testing this hypothesis is one of the main aims of this work. Other science goals including understanding the physics forcing the flow, and quantifying fluxes of volume, heat, freshwater and nutrients.

All moorings (recovered and deployed) measure water velocity, temperature and salinity near bottom (as per historic measurements). Additionally, 6 of the 8 moorings (i.e., all eastern channel moorings, the climate site mooring A3, and the mooring central in the western channel, A11) also carried upward-looking ADCPs (measuring water velocity in 1-2 m bins up to the surface, ice motion, and medium quality ice-thickness) and ISCATS (upper level temperature-salinity-pressure sensors in a trawl resistant housing designed to survive impact by ice keels). Bottom pressure gauges were also deployed on the moorings at the east-west extremes of the strait (A12-10 and A4-10). (Note in the recovered moorings, bottom pressure gauges were deployed only at A2W-09 and A4-09). Two moorings (A2-10, central eastern channel; and A12-10, western part of western channel) also carried ISUS nitrate sensors, moorings A11-10, A2W-10, A2-10 and A4-10 carried biowiper Fluorometer and Turbidity instruments, and moorings A2W-10 and A3-10 carried whale acoustic recorders. For a full instrument listing, see the table below.

This coverage should allow us to assess year-round stratification in the strait and also to study the the physics of the Alaskan Coastal Current, a warm, fresh current present seasonally in the eastern channel, and suggested to be a major part of the heat and freshwater fluxes [*Woodgate and Aagaard*, 2005; *Woodgate et al.*, 2006]. The current meters and ADCPs (which give an estimate of ice thickness and ice motion) allow the quantification of the movement of ice and water through the strait. The nutrient sampler, the transmissometer and fluorometer time-series measurements should advance our understanding of the biological systems in the region.

2010 Recoveries and Deployments: Mooring operations went extremely smoothly in 2010. For recoveries, the ship positioned ~ 200m away from the mooring such as to drift over the mooring site. Ranging was done from the aft-deck adjacent to the wet-lab. Without exception, acoustic ranges agreed to within 30m of the expected mooring position. Once the ship had drifted over the mooring and the acoustic ranges had increased to > 100m, the mooring was released. This procedure was followed

to prevent the mooring being released too close (or underneath) the ship since in previous years the moorings have taken up to 15min to release. With one exception (A2W), all moorings released successfully on the first release attempt. On A2W, although the first release command was confirmed acoustically by the instrument, the mooring did not surface. The ship repositioned and the second release was fired successfully. On recovery, the first release was found to have activated, but the hook had not released and could not be pulled clear by hand. No clear explanation for the hang-up is available. A gelatinous biofouling was present on recovery, possibly gaining sufficient mechanical advantage to have held the hook in place. Another possibility is that the pin that turns did not turn completely to straight and under certain lateral forces on the release (drag on the mooring) this may have caused it to hang up on the hook. ***Action item: repaint antifouling on releases. Recheck pin alignment on all releases.***

Once the mooring was on the surface, the ship repositioned, bringing the mooring tightly down the starboard side of the ship. Two grapples and a pole with a quick releasing hook attached to a line were used to catch the mooring. The line from the hook was fastened onto an extension on the port-crane, and the mooring lifted aboard. If the pick was too long for the crane, a stopper chain on the starboard rail was used. Iscats (when present) were recovered by hand while the top float was lifted clear of the water by the crane.

Mooring deployments were done through the aft A-frame, using the ship's trawl wire and block for lifting. The mooring was assembled completely within the A-frame. The ship positioned to steam slowly (~2 knots) into the wind/current. When the ship was approximately 10min from the mooring position, mooring deployment started. The ISCAT was deployed by hand and streamed behind the ship. The top pick (usually float) was deployed using a quick release. Then the anchor was lifted into the water. When the ship arrived on site, the anchor was dropped using the mechanical quick release. Positions were taken using a hand-held GPS on the aft deck by the A-frame. As necessary, slip lines were used to lower equipment on the mooring between picks over the stern.

Action items:

- design pick points into the moorings for recovery

- shorten BPG mount as the current length is very close to the A-frame reach

- put 2 rings on the anchors for tag lines

Consider

- using chain, not line for the moorings (saves on splicing and gives extra pick points)

Instrumentation issues: Most instrumentation was started in Nome or aboard ship on the day prior to sailing. All instrumentation was started successfully, although there was a learning curve in establishing that the SBE-16+ biowipers had been set on continuous (CTD) mode, rather than mooring mode. This was corrected before deployment.

Overall, data recovery on the moorings was very good.

Of the 6 iscats deployed, 4 were recovered with full recorders. Two iscats (from moorings A4 and A4W) were not present when the mooring was released. Data records from the loggers on these instruments cease at the start of November, but we hypothesize this is not due to loss of the iscat, as the loggers of the recovered iscats also stopped recording around these dates. All loggers recovered had battery voltages below the cut-off voltage for the logger, a state in which they cease to record data. The reason for this battery depletion is not clear - it may relate to insufficient sea-water connection for the inductive modem, or due to generally high power consumption or low powered batteries. In case the failure was due to the latter, where possible (A3 and A11) the newly deployed loggers were set on 1hr sample interval rather than the previous 30min sample interval. ***Revise power cut off for Iscat loggers.***

Of the 6 ADCPs recovered, 5 recorded full records, although in the case of 9396 the instrument stopped briefly after deployment and then restarted with the same sampling regime, thus recording 2 data files. The 6th (11698 on A11) also recorded 2 data files. In this case, however, the 2nd file (started about 1 month after deployment) is of a completely different bin/ping set up to the first. Furthermore, for this second file the ADCP had lost its compass calibration and its clock. Preliminary investigation suggests that period without data is only short (less than 2 days), and, also positively, the data recovered may be reasonable, albeit with greater errors in velocity and direction (ship-board tests

suggest direction errors are < 15deg). ***1) Do post-deployment compass test on 11698. 2) Follow up with RDI about instruments stopping while in the water.***

Two Aanderaa RCMs were recovered with complete data records, even though one (1173) leaked, possibly through the salinity sensor, which returned only erroneous data. The interior of the instrument (especially the paper DSU label) was wet on opening, however the leak appears to have been contained by the packet desiccant inside.

The three Microcats recovered contained complete data records.

The two bottom pressure recorders also contained compete data records.

Of the 5 SBE16s, 4 contained complete records. The 5th (SBE16plus on A12-09) had low battery and had stopped recording in July 2010. Possibly this is due to a pump delay time of 10s.

The two ISUS instruments also contained almost complete data records, one still running on recovery, and one having stopped one week before recovery.

The two Whale recorder instruments also suffered from draining batteries, but yielded records lasting until January or March (see report below).

The AARI RCM on A11-09 was recovered hanging upside down, with the endplate under the rotor torn from the instrument and the bottom vane missing. The mooring was saved by the presence of a safety line, which had been strapped to the instrument on deployment because the deployment team were suspicious of the strength of the current meter, even though the frame of the instrument was apparently rated appropriately for the tension of the mooring. The instrument stopped recording meaningful speed after a few months, suggesting this was the time of failure. Other sensors on the meter (temperature and pressure) continued recording beyond this.

Details of mooring positions and instrumentation are given below, along with schematics of the moorings, photos of the mooring fouling, and preliminary plots of the data as available.

RUSALCA 2010 BERING STRAIT MOORING POSITIONS AND INSTRUMENTATION

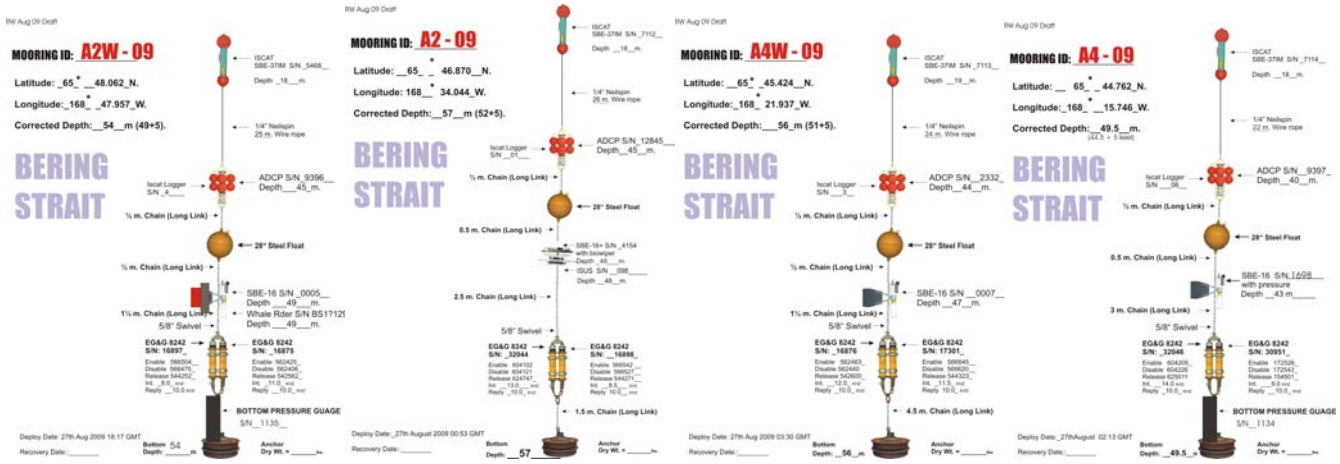
ID	LATITUDE (N) (WGS-84)	LONGITUDE (W) (WGS-84)	WATER DEPTH /m (corrected)	INST.
09 Recoveries				
- Russian EEZ				
A11-09	65 54.002	169 25.984	52	ISCAT, ADCP, SBE37
A12-09	65 55.993	169 37.005	51	ISUS, SBE/TF, RCM9
A13-09	65 52.006	169 16.987	51	AARI, RCM9T, SBE37
- US EEZ				
A2W-09	65 48.062	168 47.957	54	ISCAT, ADCP, SBE16, WR, BPG
A2-09	65 46.870	168 34.044	57	ISCAT, ADCP, SBE/TF, ISUS
A4W-09	65 45.424	168 21.937	56	ISCAT, ADCP, SBE16
A4-09	65 44.762	168 15.746	50	ISCAT, ADCP, SBE16, BPG
A3-09	66 19.601	168 57.928	58	ISCAT, ADCP, SBE37, WR

ID	LATITUDE (N) (WGS-84)	LONGITUDE (W) (WGS-84)	WATER DEPTH /m (corrected)	INST.
10 Deployments				
- Russian EEZ				
A11-10	65 54.001	169 25.985	52	ISCAT, ADCP, SBE37
A12-10	65 56.007	169 36.990	50	ISUS, SBE/TF, RCM9, BPG
A13-10	65 52.000	169 16.987	50	AARI, RCM9, SBE37
- US EEZ				
A2W-10	65 48.071	168 47.903	53	ISCAT, ADCP, SBE16, WR, FLT
A2-10	65 46.872	168 34.048	56	ISCAT, ADCP, SBE/TF, ISUS
A4W-10	65 45.423	168 21.974	55	ISCAT, ADCP, SBE16
A4-10	65 44.763	168 15.755	49	ISCAT, ADCP, SBE16, FLT ,BPG
A3-10	66 19.610	168 57.925	58	ISCAT, ADCP, SBE37, WR

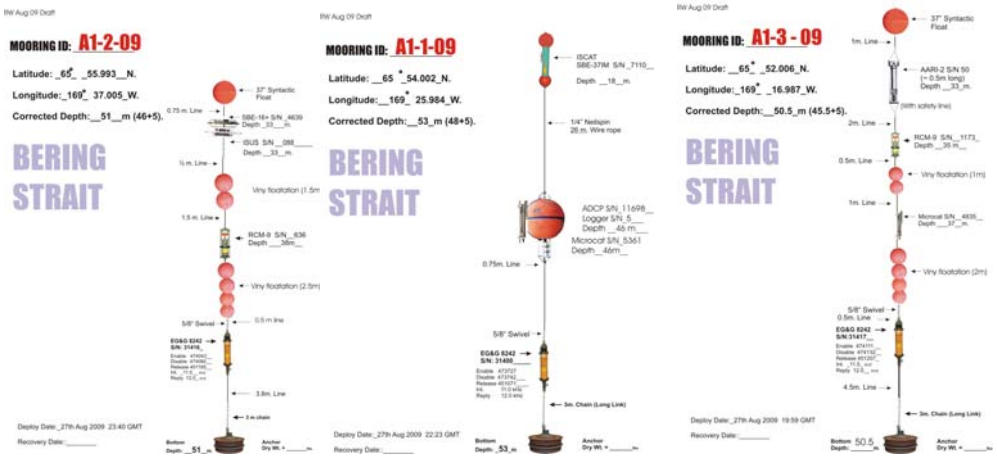
AARI = AARI Current meter and CTD ADCP = RDI Acoustic Doppler Current Profiler
BPG=Seabird Bottom Pressure Gauge FLT=Wetlabs Biowiper Fluoresence& Turbidity recorder
ISCAT = near-surface Seabird TS sensor in trawl resistant housing, with near-bottom data logger
ISUS= Nutrient Analyzer
RCM9= Aanderaa Acoustic Recording Current Meter
RCM9T = Aanderaa Acoustic Recording Current Meter with Turbidity
SBE/TF = Seabird CTD recorder with transmissometer and fluorometer
SBE16 = Seabird CTD recorder SBE37 = Seabird Microcat CTD recorder
WR=Whale Recorder

RUSALCA 2010 SCHEMATICS OF MOORING RECOVERIES

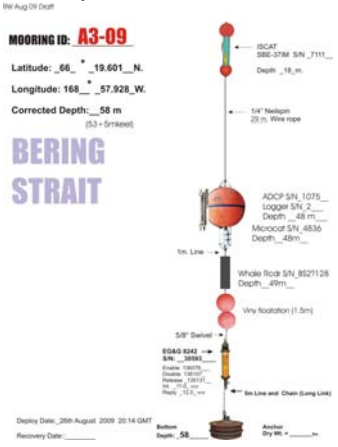
= in the eastern channel of the Bering Strait



= in the western channel of the Bering Strait

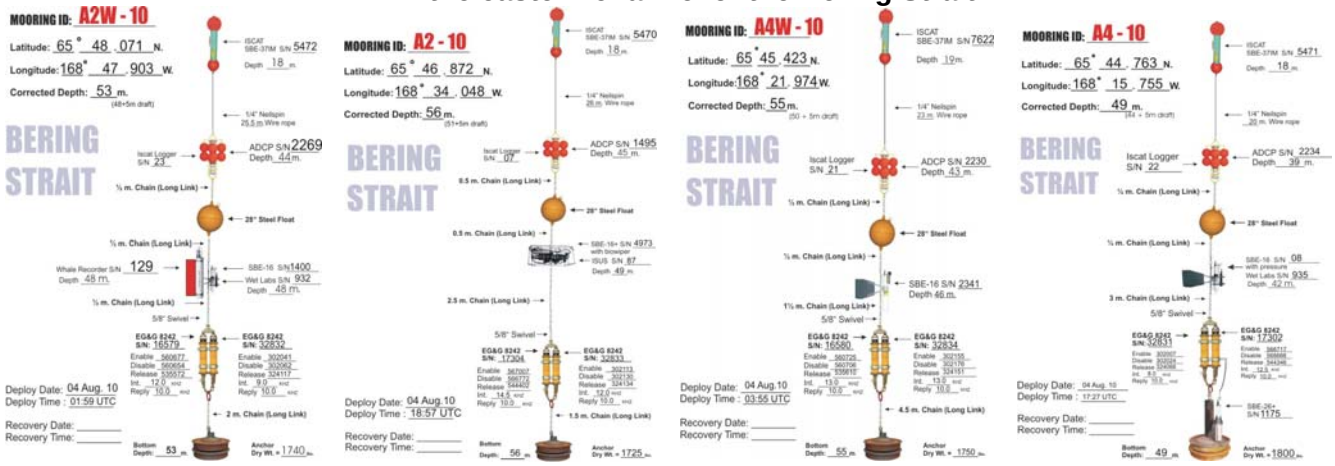


= at the climate site, ~ 60km north of the Strait

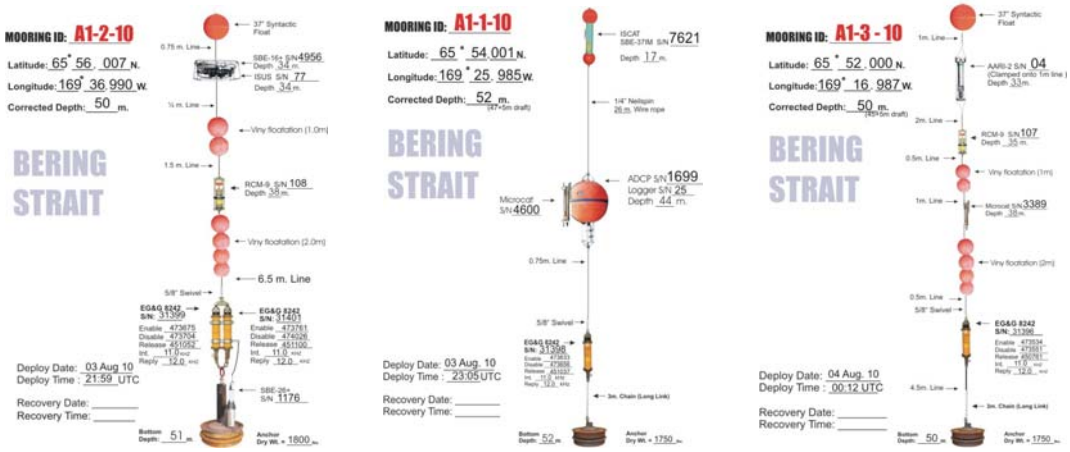


RUSALCA 2010 SCHEMATICS OF MOORING DEPLOYMENTS

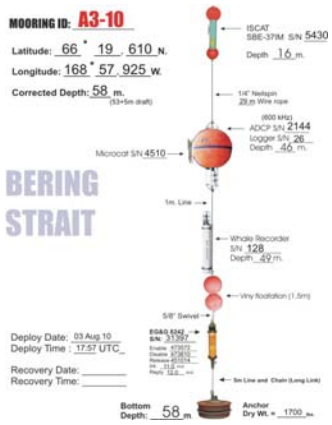
= in the eastern channel of the Bering Strait



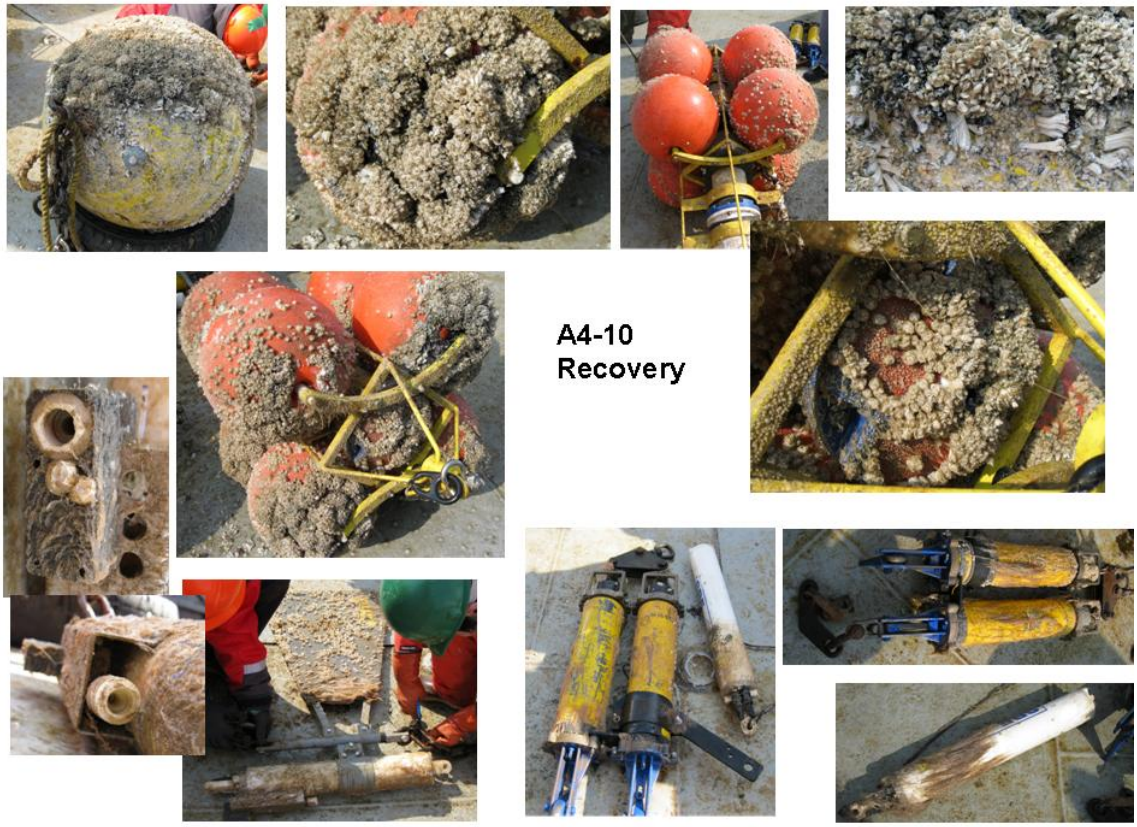
= in the western channel of the Bering Strait



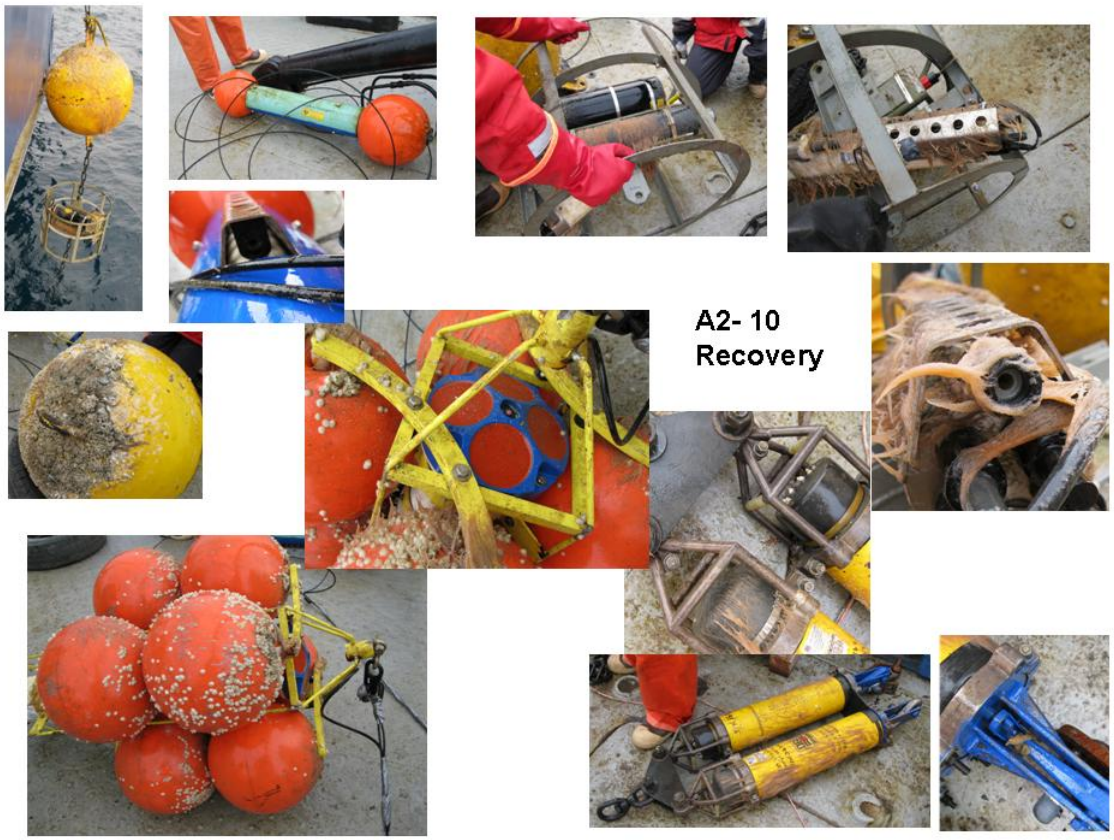
= at the climate site, ~ 60km north of the Strait



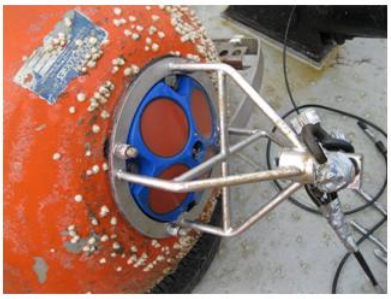
RUSALCA 2010 RECOVERY PHOTOS



RUSALCA 2010 RECOVERY PHOTOS (continued)



RUSALCA 2010 RECOVERY PHOTOS (continued)

A3-10
Recovery







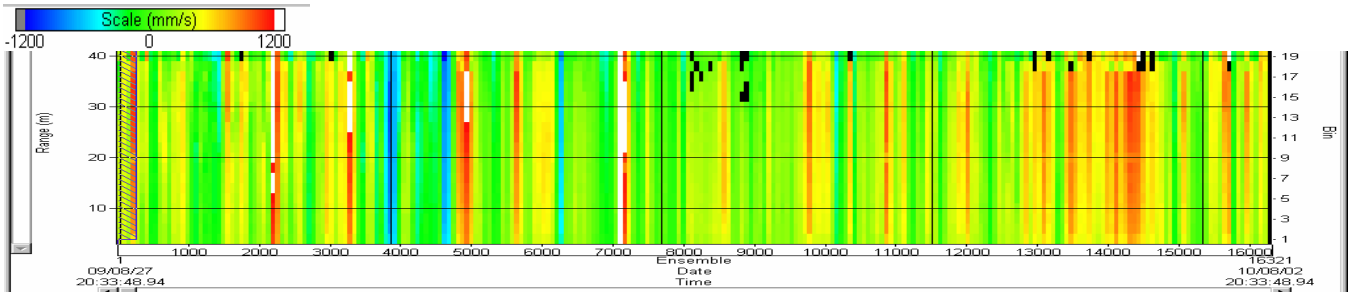
A13-10
Recovery



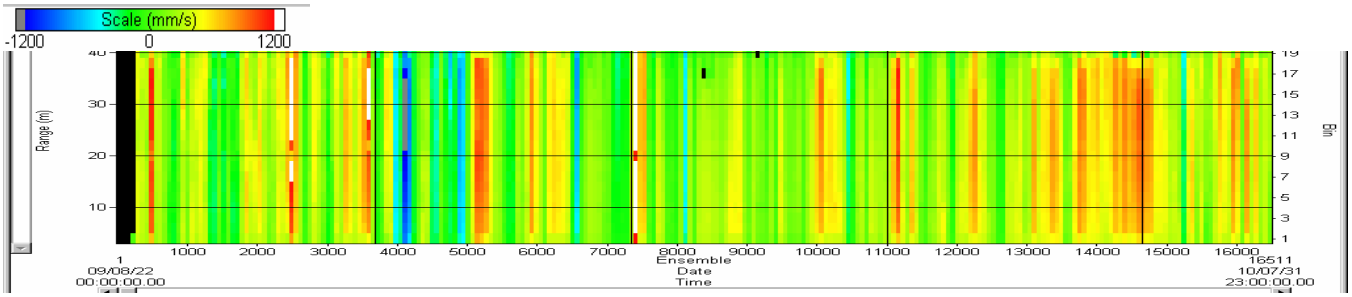


RUSALCA 2010 RECOVERY PHOTOS (continued)

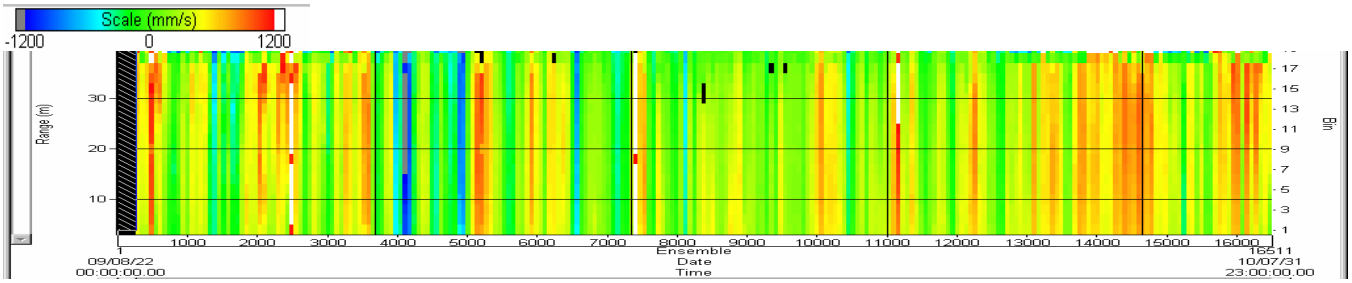
A2W-09 9396



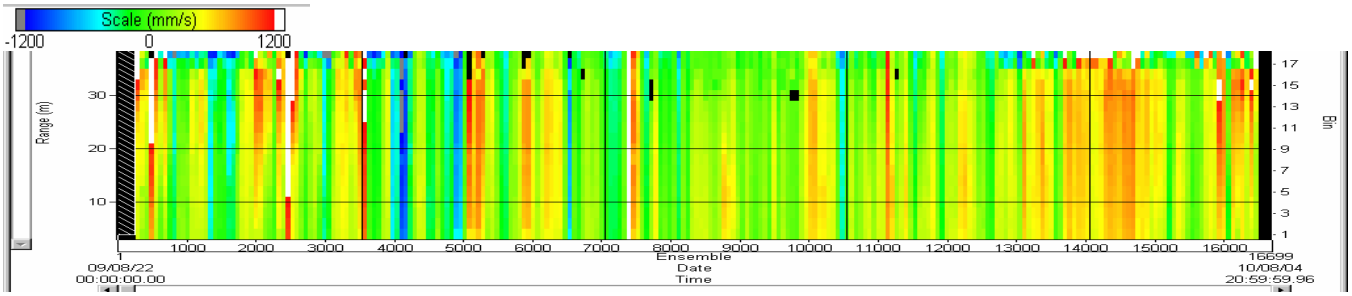
A2-09 12845



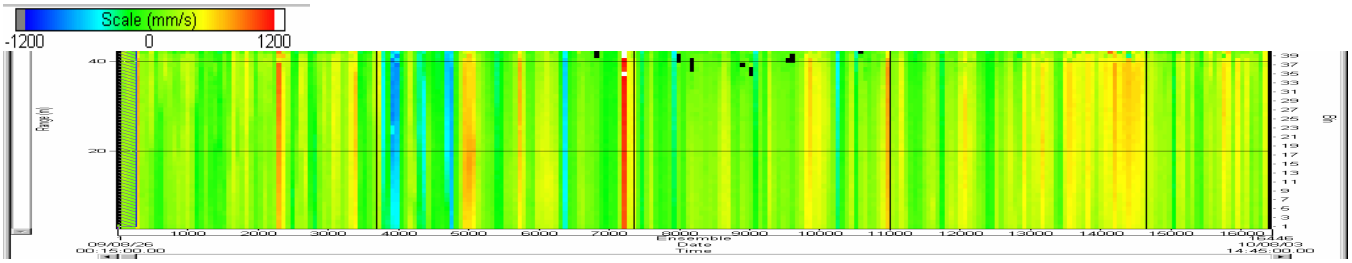
A4W-09 2332



A4-09 9397

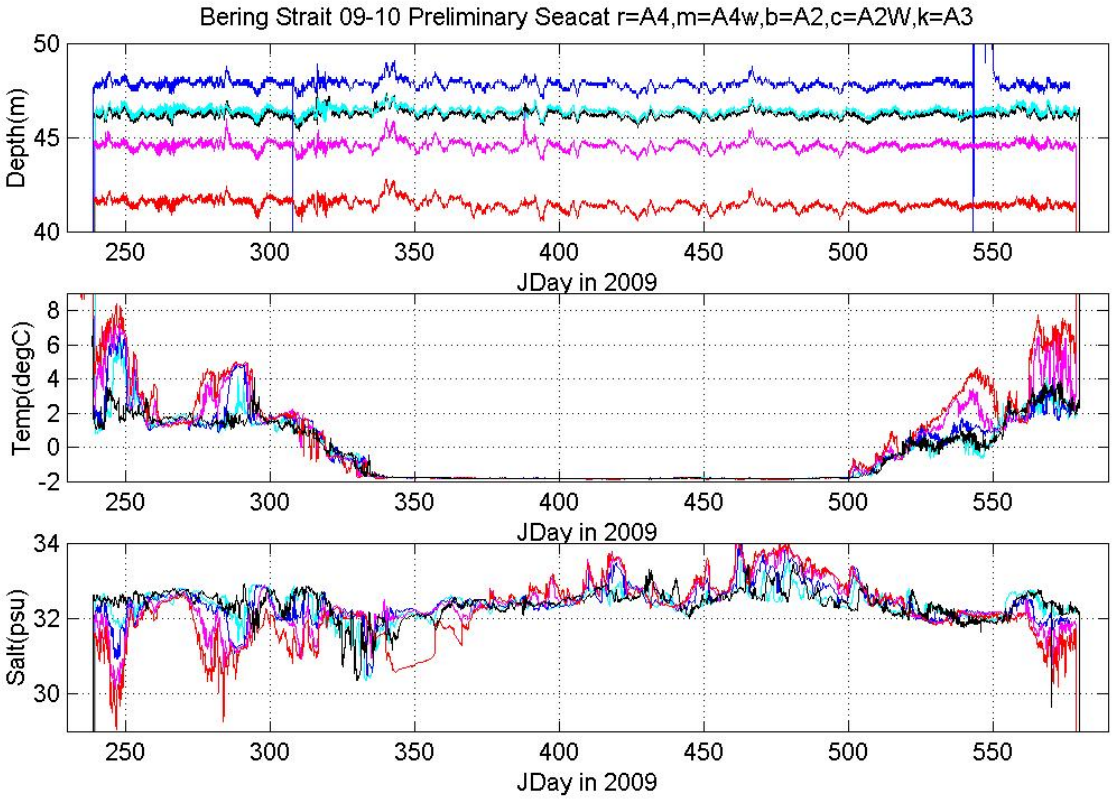


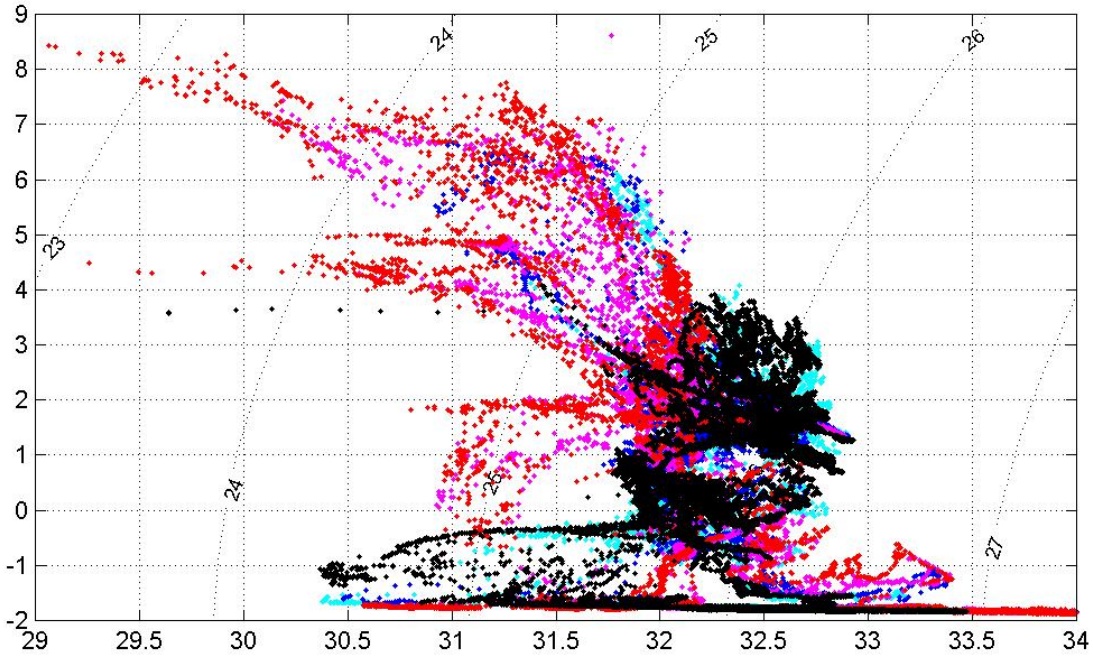
A3-09 1075



(A11-09 data not included.)

RUSALCA 2010 PRELIMINARY SEACAT RESULTS





CTD OPERATIONS (Hartz, Stoudt, Whitefield)

The moorings are usually supported by annual CTD sections, with water samples for various projects as described below.

The CTD sections for RUSALCA 2010 were taken by a CTD rosette system with the setup described below, controlled by a SBE-33 deck-unit, running the software package Seasoft. The lowering and raising was done by the ship's conducting cable winch, at a rate of ~ 0.3 m/s. Bottles were fired by the operator at the deck-unit on the up-cast. Data are recorded in standard SBE format.

Configuration Date: August 03 2010
SBE 25 CTD SN:2559287-0484

- SBE 33 Carousel Deck Unit SN:3357671-0180
- SBE 32 Carousel SN:3235784-0534
- Wetlabs FLNTURT SN:1847 (V0 FL/V1 TR)
- SBE 5T Pump SN:055663
- Biospherical QCP2300 SN:70285 (V2)
- Teledyne Benthos PSA-916 Altimeter:SN50416 (V4)
- SBE Temp 5303
- SBE Cond 3814
- SBE Pressure 0690
- Garmin 17xHVS GPS SN:1BN021515

The rosette carried twelve 1.7l bottles.

Initial concerns that the CTD rosette would be too light for the ship's winch proved unfounded. The CTD was deployed through the stern A-frame using the ship's 01 starboard 9 mm EM conducting Cable, winch and slip rings.

The positioning of a freezer container on the 01 deck, just aft of the winch controls made visibility of the A-frame difficult, but just workable.

Cameras were set up to give the CTD operator oversight of A-frame and winch operations. In future years, ***bringing more camera cable*** would allow this system to be extended to the bridge. CTDs were run using 5 people – 1 CTD operator, 1 winch driver, 1 A-frame driver, 2 persons on deck to assist catching the rosette. (In good weather, 1 person would have been sufficient.) The 2 deck persons also assisted with water sampling. CTDs were run 24hrs using a 2 or 3 watch system. Pallets were stacked under the A-frame to bring the rosette to a comfortable height for sampling.

CTD operations went extremely smoothly, and a total of 137 casts were made. Some casts (some of 9,51,108,135) had comms problems on the upcast, which was suspected to be related to low battery voltage on the internal batteries on the rosette. (The DS command does not appear to inform about internal battery voltage) – certainly, changing the CTD batteries seemed to solve the problem. ***Investigate this with SBE. Bring plenty of spare batteries. Investigate use of rechargeable batteries***

There were occasional bottles which failed to fire, but since this was near the end of the cruise (when less sampling was being done), an explanation for this was not pursued.

Generally the ship drifted during CTD operations, with screws still turning, but feathered for no thrust. Ship's draft is 5m, and this should be taken into account in viewing the data. ***Ship drift was at times substantial, and this might be investigated to get some idea of water velocity*** (combined with wind-driven drift of the ship).

Extremely fresh layers were encountered on the western stations, and some profiles show remarkable layering in temperature and fluorescence maximum.

As CTD work was 24 hr, at some stage operations were done during the dark. It was not recognized initially that the A-frame light was affecting the PAR sensor, so there is inconsistency in the CTD methodology as to if the A-frame light was on or off.

Preliminary CTD sections will be included once the Russian data have been cleared.

RUSALCA 2010 CTD Positions

The following lists give the target positions of the CTD lines. The full RUSALCA event log (as noted by the CTD operator) is also included.

```
%% Bering Strait Line
%====================
% - now 26 stations just north of the Bering Strait
% - ** added 2 stations near Russian Coast BS0.5 and BS1.5
%       to measure SCC.
% - goal - 3 km resolution, to be run in 1 day
% - 26 stations = 3.4km spacing .. closer near Coast
% - total length BS0.5 to BS24 ~ 84km
%
% Lat (N) Long (W)   Lat (N)     Long (W)
%                   deg min     deg   min
% Russian Stations
  65.989  169.678   65  59.31   169  40.74 %*1  %BS0.5
  65.980  169.643   65  58.81   169  38.56 %*1  %BS1
  65.971  169.607   65  58.28   169  36.40 %*1  %BS1.5
  65.963  169.571   65  57.75   169  34.24 %*2  %BS2
  65.945  169.498   65  56.71   169  29.87 %*3  %BS3
  65.927  169.425   65  55.65   169  25.52 %*4  %BS4
  65.910  169.352   65  54.59   169  21.11 %*5  %BS5
  65.892  169.280   65  53.55   169  16.77 %*6  %BS6
  65.880  169.214   65  52.78   169  12.83 %*7  %BS7
  65.862  169.142   65  51.72   169   8.49 %*8  %BS8
  65.841  169.072   65  50.47   169   4.31 %*9  %BS9
  65.825  169.000   65  49.50   169   0.00 %*10 %BS10
% US Stations
  65.805  168.933   65  48.31   168  55.96 %*11 %BS11
  65.788  168.860   65  47.26   168  51.62 %*12 %BS12
  65.772  168.794   65  46.33   168  47.64 %*13 %BS13
  65.755  168.721   65  45.28   168  43.29 %*14 %BS14
  65.739  168.663   65  44.35   168  39.80 %*15 %BS15
  65.722  168.591   65  43.29   168  35.46 %*16 %BS16
  65.704  168.521   65  42.23   168  31.28 %*17 %BS17
  65.686  168.449   65  41.18   168  26.94 %*18 %BS18
  65.672  168.391   65  40.35   168  23.44 %*19 %BS19
  65.655  168.318   65  39.29   168  19.09 %*20 %BS20
  65.642  168.250   65  38.53   168  14.97 %*21 %BS21
  65.625  168.177   65  37.48   168  10.63 %*22 %BS22
  65.599  168.161   65  35.96   168   9.66 %*23 %BS23
  65.582  168.117   65  34.91   168   7.00 %*24 %BS24
%
% A3L line
%=========
% - nominally 85km .. aiming at 3km resolution
% - extra station to give better resolution near Russian Coast
% - 13 on the Russian side, 12 on US side
% gives us about 3.4 km resolution
% - total listed here = 77 km
%
%  Lat (N)   Long (W)   Latdeg    Lat min  Lon deg   Lon min
% Russian Stations
   66.1190  169.5931   66.0000    7.1400  169.0000   35.5850 %*48 %AL1
   66.1285  169.5646   66.0000    7.7100  169.0000   33.8775 %*48 %AL1.5
   66.1380  169.5362   66.0000    8.2800  169.0000   32.1700 %*47 %AL2
   66.1570  169.4793   66.0000    9.4200  169.0000   28.7550 %*46 %AL3
   66.1760  169.4223   66.0000   10.5600  169.0000   25.3400 % 45 %AL4
```

```
   66.1950  169.3654   66.0000   11.7000  169.0000   21.9250 %*44 %AL5
   66.2140  169.3085   66.0000   12.8400  169.0000   18.5100 % 43 %AL6
   66.2330  169.2516   66.0000   13.9800  169.0000   15.0950 %*42 %AL7
   66.2520  169.1947   66.0000   15.1200  169.0000   11.6800 % 41 %AL8
   66.2710  169.1378   66.0000   16.2600  169.0000    8.2650 %*40 %AL9
   66.2900  169.0808   66.0000   17.4000  169.0000    4.8500 % 39 %AL10
   66.3090  169.0239   66.0000   18.5400  169.0000    1.4350 %*38 %AL11
%US stations
   66.3280  168.9670   66.0000   19.6800  168.0000   58.0200 % 37 %AL12
   66.3398  168.8952   66.0000   20.3867  168.0000   53.7092 %*36 %AL13
   66.3516  168.8233   66.0000   21.0933  168.0000   49.3983 % 35 %AL14
   66.3633  168.7515   66.0000   21.8000  168.0000   45.0875 %*34 %AL15
   66.3751  168.6796   66.0000   22.5067  168.0000   40.7767 % 33 %AL16
   66.3869  168.6078   66.0000   23.2133  168.0000   36.4658 %*32 %AL17
   66.3987  168.5359   66.0000   23.9200  168.0000   32.1550 % 31 %AL18
   66.4104  168.4641   66.0000   24.6267  168.0000   27.8442 %*30 %AL19
   66.4222  168.3922   66.0000   25.3333  168.0000   23.5333 % 29 %AL20
   66.4340  168.3204   66.0000   26.0400  168.0000   19.2225 %*28 %AL21
   66.4458  168.2485   66.0000   26.7467  168.0000   14.9117 % 27 %AL22
   66.4576  168.1767   66.0000   27.4533  168.0000   10.6008 %*26 %AL23
   66.4693  168.1048   66.0000   28.1600  168.0000    6.2900 %*25 %AL24
%
% Cape Serdtse Kamen to Point Hope
%=======================================
% = Now station list is 19 stations
% (including old Russian stations)
% has 4-5km spacing within 15km of the coast
% 20km spacing elsewhere
% R = old Rusalca stations
%%  Lat (N)   Long (W)   Latdeg    Lat min  Lon deg   Lon min
%Russian stations
   66.8300  171.2567   66.0000   49.8000  171.0000   15.4000    %*49 %CS1
   66.8649  171.1678   66.0000   51.8920  171.0000   10.0697    % 50 %CS2
   66.8997  171.0790   66.0000   53.9840  171.0000    4.7393    %*51 %CS3
   66.9346  170.9902   66.0000   56.0760  170.0000   59.4090  %R%*52 %CS4
   67.0622  170.6377   67.0000    3.7325  170.0000   38.2645    % 53 %CS5
   67.1898  170.2853   67.0000   11.3890  170.0000   17.1200  %R%*54 %CS6
   67.3110  169.9413   67.0000   18.6620  169.0000   56.4785    % 55 %CS7
   67.4322  169.5973   67.0000   25.9350  169.0000   35.8370  %R%*56 %CS8
   67.5334  169.3070   67.0000   32.0065  169.0000   18.4215    % 57 %CS9
   67.6346  169.0168   67.0000   38.0780  169.0000    1.0060  %R%*58 %CS10
   67.7551  168.6652   67.0000   45.3030  168.0000   39.9110    % 59 %CS11
%US stations
   67.8755  168.3136   67.0000   52.5280  168.0000   18.8160  %R%*60 %CS12
   67.9887  167.9894   67.0000   59.3235  167.0000   59.3660    % 61 %CS13
   68.1020  167.6653   68.0000    6.1190  167.0000   39.9160  %R%*62 %CS14
   68.2008  167.3568   68.0000   12.0470  167.0000   21.4080    % 63 %CS15
   68.2502  167.2026   68.0000   15.0110  167.0000   12.1540    % 64 %CS16
   68.2996  167.0483   68.0000   17.9750  167.0000    2.9000  %R%*65 %CS17
   68.3156  166.9600   68.0000   18.9375  166.0000   57.6000    % 66 %CS18
   68.3317  166.8717   68.0000   19.9000  166.0000   52.3000    %*67 %CS19
```

```
% New line to look at SCC north of Cape SK
%=======================================
% 22 stations, same spacing as before, i.e., 1 nm near coast, 1.8 away
% from coast.
% Longitude set to be within box, but just N of cape
% Named Cape Netten for Cape just N of CSK         % All Russian
% Lat (N)         Long (W)       Name
% deg  min        deg   min
  66  59.00       171   48.00       %CN1  + net
  67  00.00       171   48.00       %CN1.5
  67  01.00       171   48.00       %CN2
  67  02.80       171   48.00       %CN3
  67  04.60       171   48.00       %CN4
  67  06.40       171   48.00       %CN5
  67  08.20       171   48.00       %CN6
  67  10.00       171   48.00       %CN7
  67  11.80       171   48.00       %CN8
  67  13.60       171   48.00       %CN9  + net
  67  15.40       171   48.00       %CN10
  67  17.20       171   48.00       %CN11
  67  19.00       171   48.00       %CN12
  67  20.80       171   48.00       %CN13
  67  22.60       171   48.00       %CN14
  67  24.40       171   48.00       %CN15
  67  26.20       171   48.00       %CN16
  67  28.00       171   48.00       %CN17
  67  29.80       171   48.00       %CN18  + net
  67  31.60       171   48.00       %CN19
  67  33.40       171   48.00       %CN20
  67  35.20       171   48.00       %CN21

% The Hunt for the SCC
%=====================
% On the CN and CS lines we found very fresh water, which was not
% on the A3L ... where did it go off the coast?
% These next 2 lines are set to try and map it.

% Between the CS line and the A3L line is about 60nm.
% Split that in 3 .. gives us 20 miles between the lines.
% We have to move that a little bit north as there is a 5mile
% marine mammal exclusion zone around Cape Inchou (sp?).
%
% Each line about 40nm, heading as per CS.    All Russian
%
% CV line  (run CV1 to CV11)
%========
%     Lat (N)          Long (W)    Name
%     deg   min        deg   min
      66   35.50       170   46.30 %CV1
      66   36.90       170   42.66 %CV1.5
      66   38.30       170   39.01 %CV2
      66   41.09       170   31.72 %CV3
      66   43.89       170   24.43 %CV4
      66   46.68       170   17.14 %CV5
      66   49.48       170    9.85 %CV6
      66   52.28       170    2.55 %CV7
      66   55.07       169   55.26 %CV8
      66   57.87       169   47.97 %CV9
      67    0.66       169   40.68 %CV10
      67    3.46       169   33.39 %CV11
```

```
%
% CX line  (run CX11 to CX1)
%========
%     Lat (N)           Long (W)    Name
%     deg   min         deg   min
      66   22.00        170   16.30 %CX1
      66   23.39        170   12.70 %CX1.5
      66   24.77        170    9.10 %CX2
      66   27.54        170    1.90 %CX3
      66   30.31        169   54.70 %CX4
      66   33.08        169   47.50 %CX5
      66   35.85        169   40.30 %CX6
      66   38.62        169   33.10 %CX7
      66   41.39        169   25.90 %CX8
      66   44.16        169   18.70 %CX9
      66   46.93        169   11.50 %CX10
      66   49.70        169    4.30 %CX11
```

Reports from Water Sampling Teams

RUSALCA 2010 Cruise Report--Water Sampling

-Michael Kong, Daniel Naber and Terry Whitledge--University of Alaska, Fairbanks

The group from the University of Alaska, Fairbanks were responsible for a suite of different water samples. These samples consisted of the following: Dissolved Inorganic Carbon (DIC), Dissolved Organic Nitrogen (DON), Nutrients (nitrate, nitrite, ammonium, urea, phosphate and silica) and total chlorophyll *a*. All samples were taken at the following standard depths: 0 m, 10 m, 20 m, 30 m, 40 m and bottom. In the case of DON, nutrients and total chlorophyll *a*, additional samples were drawn at the subsurface chlorophyll max (if present).

Dissolved Inorganic Carbon

DIC samples were taken at every other station in the Bering Strait line beginning with station BS24. All DIC samples were taken at standard depths and transferred directly into 225 ml glass bottles. Each sample was subsequently spiked with 100 µl of mercuric chloride ($HgCl_2$) to halt biological activity. A total of 76 samples were taken in the Bering Strait. Samples were sent to Nicolas Bates (Bermuda Institute of Ocean Sciences) for analysis.

Dissolved Organic Nitrogen

DON samples were taken at every other station on both the Bering Strait and CS lines. DON samples were taken at standard depths and filtered directly from the rosette into 60 ml polycarbonate bottles using 47 mm Whatman GF/F microfibre glass filters. A total of 98 samples were taken from the combined Bering Strait/CS lines. Samples were frozen and sent to the University of Alaska, Fairbanks for analysis.

Nutrients

Nutrient samples were taken at every station during the duration of the cruise. Nutrient samples were taken at standard depths and transferred into 20 ml scintillation vials. A total of 776 samples were taken. Samples were immediately frozen and sent to the University of Alaska, Fairbanks for analysis.

Total Chlorophyll a

Total Chlorophyll *a* samples were taken at every station with the exception of the second pass across the Bering Strait line. Samples were taken at standard depths and, depending on the fluorometric trace, transferred to either 125 or 250 ml polycarbonate bottles. Samples were immediately filtered using 25mm Whatman GF/F microfibre glass filters. A total of 679 samples were taken. Filters were stored in 10 ml glass test tubes, frozen and sent to the University of Alaska, Fairbanks for analysis.

RUSALCA 2010 Cruise Report--Primary Productivity

-Michael Kong and Terry Whitledge--University of Alaska, Fairbanks

Dual isotope primary productivity experiments were run on four days during the research cruise. Primary productivity station names and locations are as follows:

Station	Cast #	Date	Latitude	Longitude
A2	1	08/04/10	65°47.21N	168°33.10W
A1-2	30	08/05/10	65°56.204N	169°36.944W
CS6	71	08/07/10	67°11.069N	170°17.526W
CN21	101	08/08/10	67°34.747N	171°48.172W

The following illustrates the amount and purpose of primary productivity water samples:

Sample	Amount (ml)	Purpose
$^{13}C + {}^{15}NO_3^-$	1000 per sample depth	Productivity incubation
$^{13}C + {}^{15}NH_4^-$	1000 per sample depth	Productivity incubation
Particulate Organic Carbon (POC)	250 per sample depth	Natural abundance of stable isotopes
Total Chlorophyll *a*	125 per sample depth	Chlorophyll biomass
Nutrients	20 per sample depth	Nutrient concentration at sample depths

Sample depths corresponded to the following light levels: 100%, 50%, 30%, 12%, 5% and 1%. These light depths were determined via the photosynthetically available radiation (PAR) trace. Water was sampled in 1000 ml polycarbonate bottles covered in metal screens corresponding to the above light levels. Samples were spiked with 1 ml of ^{13}C stable isotope solution and, depending on the treatment, either 0.5 ml of $^{15}NO_3^-$ or $^{15}NH_4^+$ stable isotope solution. In total, two sets (one set constitutes six bottles--one for each light depth) of screened bottles were used for the productivity experiments: one for $^{15}NO_3^-$ experiments and one for $^{15}NH_4^+$ experiments. Each set was placed into a deck incubator filled with cold flowing seawater for approximately four to six hours (depending on cloudiness). After incubation, 500 ml of each sample were filtered through 25mm Whatman GF/F microfibre glass filters. The samples were placed in 47 mm petri dishes, frozen and sent to the University of Alaska, Fairbanks for analysis.

POC samples were filtered through 25mm Whatman GF/F microfibre glass filters, placed in 47 mm petri dishes, frozen and sent to the University of Alaska, Fairbanks for analysis. Total chlorophyll and nutrient samples were treated in the same manner as described in the "water sampling" section.

Phytoplankton CTD Sampling for RUSALCA 2010 - Valentina Sergeeva

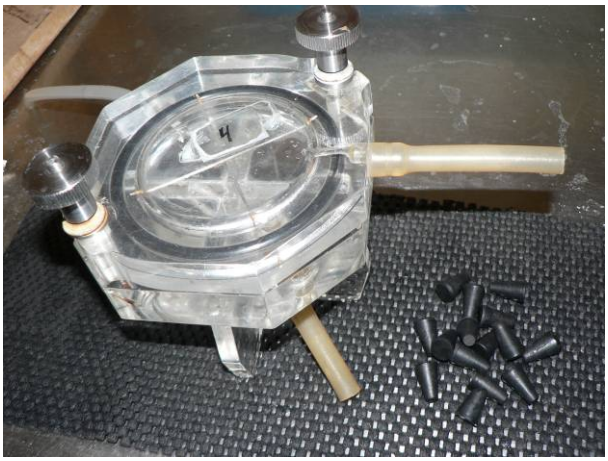
The goal of the research was to continue previous investigation of phytocenosis of the Chukchi Sea, including species composition and quantitative distribution. Investigations of the phytoplankton structure may provide the evidence of interannual variability of phytoplankton succession and elucidate the influence of abiotic factors on this succession

.

During the RUSALCA – 2010 expedition, phytoplankton samples were collected on CTD lines in the Bering Strait, in the southern Chukchi and on lines extending from the Russian coast across the Siberian Coastal Current. All the CTD lines of the cruise were sampled, except for the CX line and the repeat of the BS line. . The work was completed by researchers of Shirshov Institute of Oceanology (SIO) RAS, Valentina M. Sergeeva and Konstantin A. Solovyev.

Materials and methods

Samples for assessing vertical distribution of phytoplankton were taken from the 1.7 l Niskin bottles of the CTD rosette. The samples were taken from 3-6 levels, depths being chosen with reference to the CTD profile (upper layer, above the pycnocline, below the pycnocline, the fluorescence maximum, and bottom layer). The concentration of phytoplankton samples was carried out using chambers of reverse filtration (gentle filtration, see photo below) with 1 μm mesh size filter. The initial volume of water from each 1.7 l Niskin bottle was reduced to 50-100 ml. The samples were fixed by formaldehyde with 2% concentration in each sample. In total 243 samples were obtained from a total of 57 stations.



Chamber of reverse filtration.

Zooplankton Net Sampling for RUSALCA 2010 - Elizaveta Ershova

The zooplankton team during the RUSALCA-2010 research cruise consisted of 2 members from the Shirshov Institute of Oceanology (Moscow) - Elizaveta Ershova and Konstantin Soloviev. Sampling was conducted on two lines along the Bering Strait, on one line through the southern part of the Chukchi sea and on one line in the East-Siberian Sea.

The main objective of this research was the continuation of the long-term observations of pelagic ecosystems of the Chukchi region, which were started in 2004. These observations include the study of composition and quantitative distribution of zooplankton and description of the ecosystem structure.

Methods.

Quantitative samples of mesozooplankton were collected using paired standard Bongo nets with a mesh size of 150 μm and opening diameter of 60 cm (pic.1). Use of this type of net allows us to compare data collected during this cruise with data from other expeditions, such as RUSALCA-2004, SBI and OE, as well as earlier databases. The described arrangement of paired net was towed vertically from the sea floor to the surface on each station. The wire speed for lowering and raising the net was 0.5m/sec. We collected a total of 22 samples.

In addition to vertical tows, we performed horizontal tows using a paired Bongo frame with nets of a mesh size of 505 μm. These nets were cast from the stern of the ship with a 30° wire angle and retrieved with the ship moving at a speed of 2 kn. Horizontal casts with nets of a larger mesh size allow us to filter larger volumes of water and quantify rarer larger taxa (macrozooplankton). We collected a total of 5 macrozooplankton samples.

All samples were preserved using 3.7% formalin. They will later be processed for taxonomic composition of zooplankton and biomass.

Paired Bongo 150 μm nets

Horizontally towed Bongo 505 μm nets

Report from Whale Observation Team (Stafford and Esch)

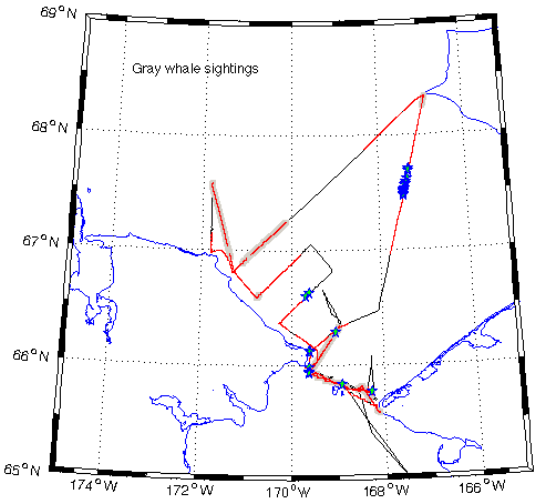
Marine Mammal sightings on RUSALCA 2010 Kate Stafford and Carter Esch

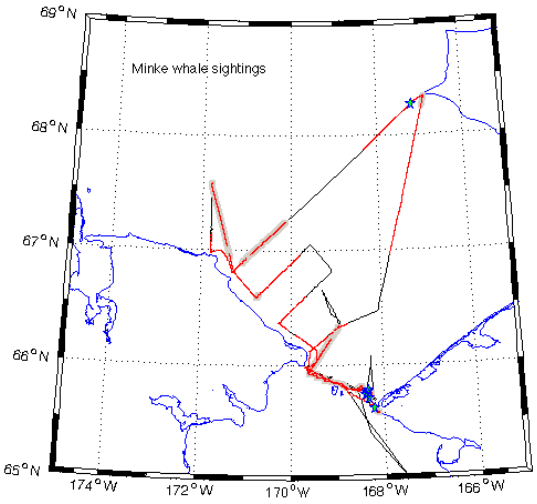
In order to document marine mammal species seen along the trackline of the Professor Khromov during the 2010 Rusalca mooring cruise, a marine mammal watch was kept on the bridge from ~0800-2300 daily. The watch was halted during mooring operations, some meals, heavy fog and when the ship was not actively moving forward (on station for CTDs, drifting at night). Watches consisted of one person stationed primarily on the port side of the bridge (to stay out of the way of bridge operations), scanning roughly 60° to either side of the bow with a pair of Fujinon 7 x 50 binoculars. When sightings were made the time, location, species and number of animals as well as any notes on observations were logged (Tables 1 and 2). A list of all bird species (but not abundance) seen was noted daily as well (Table 3). When possible photographs were taken of mammals to confirm identification. The assistance of the officers and crew of the Khromov in sighting animals was greatly appreciated.

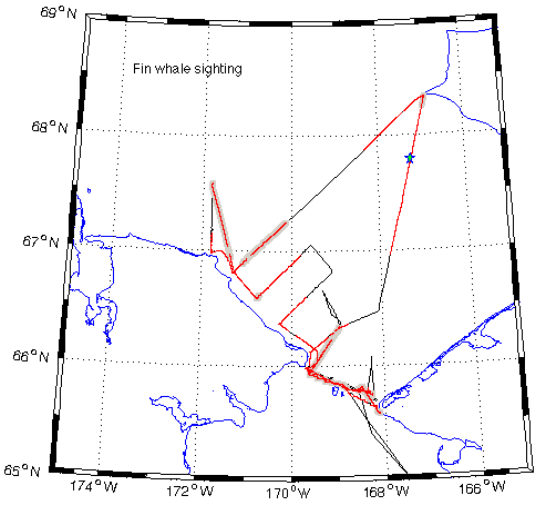
The first few days of the cruise coverage was spotty as mooring operations were in full swing and high sea states and fog were prevalent. Once the marine mammal hydrophones were recovered and redeployed, the visual survey was conducted from 0800-2300 daily. A total of 83 sightings of 230-284 individual animals were obtained representing 16 species (Table 1).

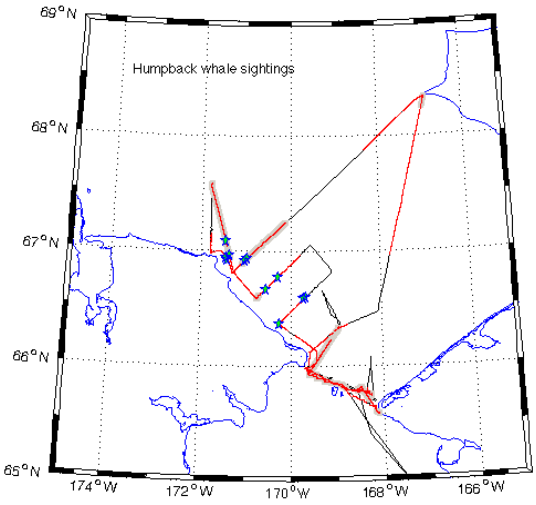
Sightings for each species are shown in the figures below. For all, black is the Khromov trackline, red the “on effort” watch trackline and gray represents transects with heavy fog (but fog is only noted when on effort, not from 2300-0800.

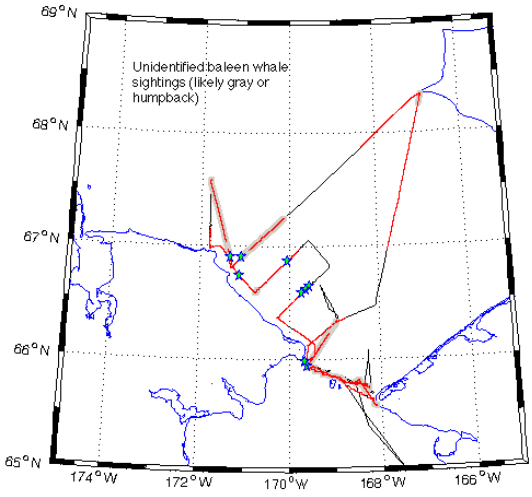
The following figures show the by-species locations of marine mammals seen on the RUSALCA cruise. The Phocoenids (harbor and Dall’s porpoise) are lumped in one panel as are the Phocid seals.

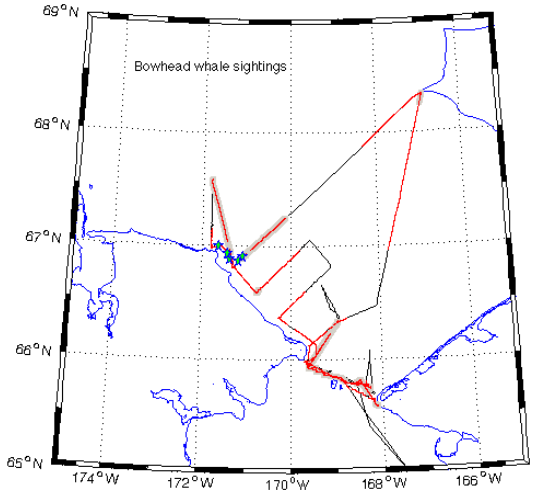


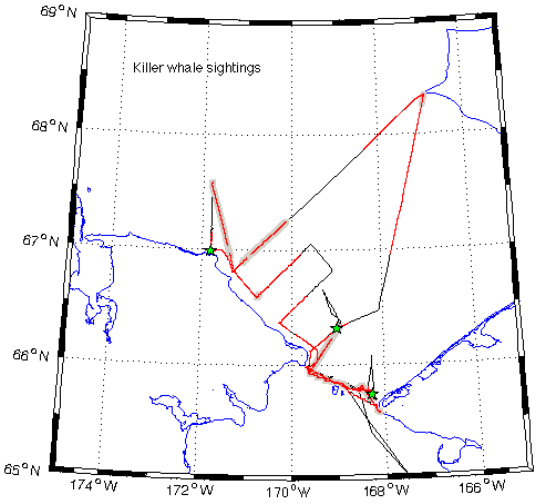


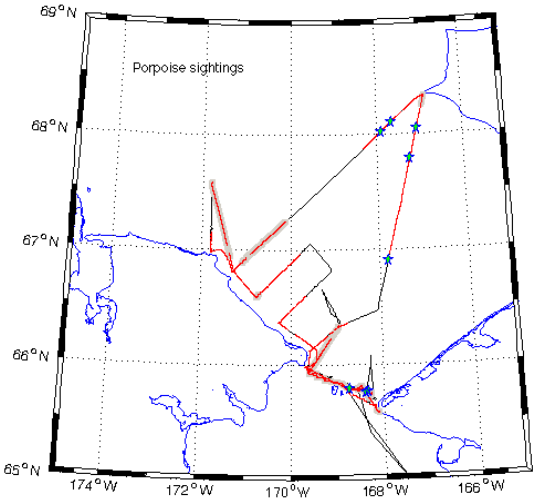

Fin whale sighting
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W

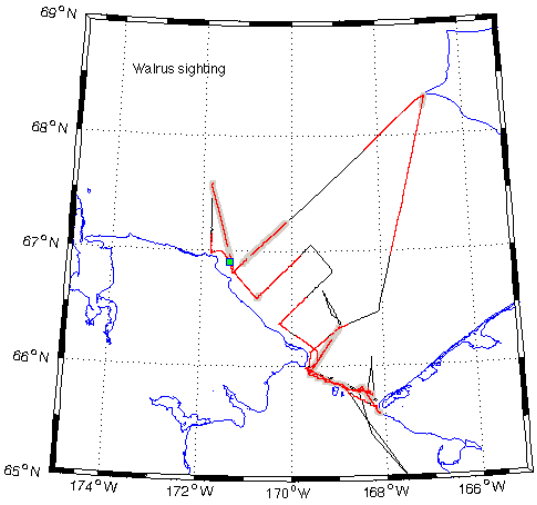

Humpback whale sightings
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W

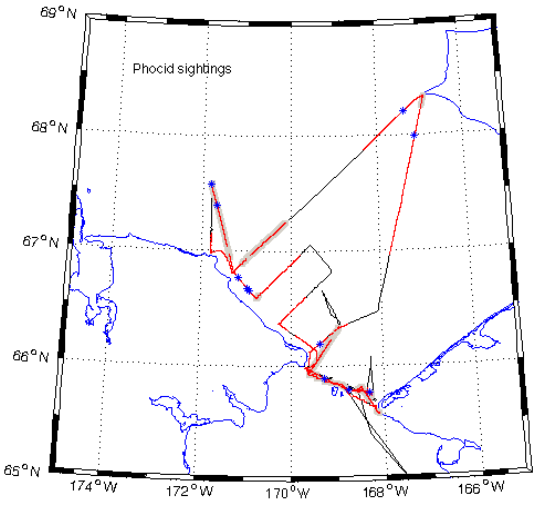

Unidentified baleen whale sightings (likely gray or humpback)
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W


Bowhead whale sightings
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W


Killer whale sightings
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W


Porpoise sightings
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W


Walrus sighting
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W


Phocid sightings
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W

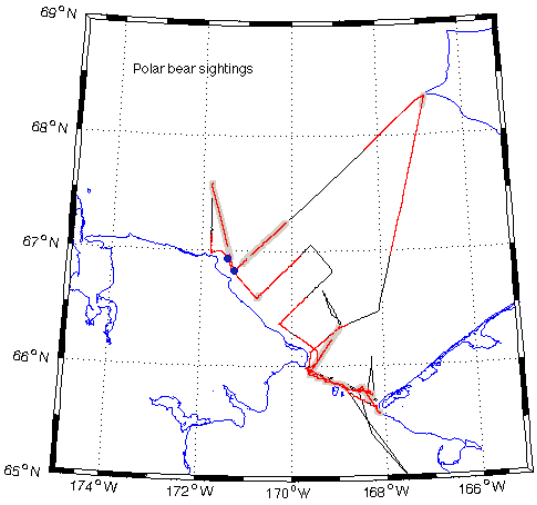

Polar bear sightings
69°N
68°N
67°N
66°N
65°N
174°W
172°W
170°W
168°W
166°W

Table 1. Marine mammal sightings by species.

Species	#sightings	number animals
harbor porpoise	4	5
minke	6	6
humpback	11	18
fin	1	1
bowhead	5	15
killer whale	3	16-20
Dall's porpoise	3	5
walrus	1	120-150
Unid baleen	9	17
Phoca spp	7	7
unid Phocoena	1	2
gray whale	25	47
polar bear	2	7
Like Bearded	1	1
Ringed seal	3	2
Bearded seal	1	1
sum	83	230-264

Table 2. Locations, times and counts for all marine mammal sightings.

event	date	time (local)	time (GMT)	declat	declon	SS	vis	spp	#
1	8/1/10	13:09	8/1/10 22:09	65.742	-168.280	4	OV	killer whale	7-10
2	8/2/10	13:20	8/2/10 22:20	65.939	-169.601	5	foggy	unid baleen	1
3	8/2/10	16:03	8/3/10 1:03	66.287	-169.033	5	OV	gray whale	1
4	8/3/10	13:43	8/3/10 22:43	65.939	-169.606			gray whale	1
5	8/3/10	13:54	8/3/10 22:54	65.934	-169.615	3	fog	gray whale	1
6	8/3/10	14:02	8/3/10 23:02	65.930	-169.618	3	fog	gray whale	1
7	8/3/10	17:19	8/4/10 2:19	65.838	-168.911	2	clear	Phoca spp	1
8	8/3/10	17:23	8/4/10 2:23	65.835	-168.891	2	clear	gray whale	1
9	8/3/10	18:09	8/4/10 3:09	65.796	-168.767	2	clear	Phoca spp	1
10	8/3/10	18:13	8/4/10 3:13	65.793	-168.735	2	clear	Harbor porpoise	1
11	8/3/10	19:18	8/4/10 4:18	65.780	-168.347	1	clear	minke whale	1
12	8/3/10	19:24	8/4/10 4:24	65.773	-168.322	1	clear	Like bearded seal	1
13	8/3/10	19:31	8/4/10 4:31	65.765	-168.342	1	clear	Harbor porpoise	2

14	8/3/10	19:36	8/4/10 4:36	65.763	-168.351	1	clear	minke whale	1
15	8/3/10	20:09	8/4/10 5:09	65.760	-168.378	1	clear	Harbor porpoise	1
16	8/4/10	8:50	8/4/10 17:50	65.773	-168.261	3	fog	gray whale	1
17	8/4/10	14:37	8/4/10 23:37	65.742	-168.377	3	clear	minke whale	1
18	8/4/10	14:52	8/4/10 23:52	65.714	-168.329	2	OV	minke whale	1
19	8/4/10	15:51	8/5/10 0:51	65.626	-168.199	2	OV	minke whale	1
20	8/5/10	13:42	8/5/10 22:42	65.978	-169.610	2	fog	gray whale	2
21	8/5/10	14:48	8/5/10 23:48	66.120	-169.593	1	fog	gray whale	1
22	8/5/10	15:10	8/6/10 0:10	66.124	-169.600	1	fog	gray whale	1
23	8/5/10	17:31	8/6/10 2:31	66.196	-169.364	1	fog	Phoca spp	1
24	8/5/10	21:26	8/6/10 6:26	66.318	-168.999	1	clear	Killer whale	7
25	8/6/10	8:40	8/6/10 17:40	66.906	-167.823	2	OV	harbor porpoise	1
26	8/6/10	11:29	8/6/10 20:29	67.475	-167.447	2	OV	gray whale	2
27	8/6/10	11:45	8/6/10 20:45	67.476	-167.446	2	OV	gray whale	5
28	8/6/10	11:50	8/6/10 20:50	67.500	-167.432	2	OV	gray whale	3
29	8/6/10	11:52	8/6/10 20:52	67.504	-167.430	2	OV	gray whale	2
30	8/6/10	11:53	8/6/10 20:53	67.507	-167.428	2	OV	gray whale	1
31	8/6/10	11:54	8/6/10 20:54	67.514	-167.424	2	OV	gray whale	2
32	8/6/10	11:55	8/6/10 20:55	67.517	-167.423	2	OV	gray whale	3
33	8/6/10	11:59	8/6/10 20:59	67.527	-167.415	2	OV	gray whale	1
34	8/6/10	12:09	8/6/10 21:09	67.561	-167.391	2	OV	gray whale	2
35	8/6/10	12:12	8/6/10 21:12	67.571	-167.383	2	OV	gray whale	3
36	8/6/10	12:16	8/6/10 21:16	67.584	-167.375	2	OV	gray whale	1
37	8/6/10	12:25	8/6/10 21:25	67.614	-167.356	2	OV	gray whale	1
38	8/6/10	12:49	8/6/10 21:49	67.686	-167.311	2	OV	gray whale	2
39	8/6/10	12:53	8/6/10 21:53	67.700	-167.302	2	OV	gray whale	3

40	8/6/10	13:19	8/6/10 22:19	67.784	-167.242	2	OV	fin whale	1
41	8/6/10	13:20	8/6/10 22:20	67.784	-167.243	2	OV	Dall's porpoise	2
42	8/6/10	14:21	8/6/10 23:21	67.986	-167.109	2	OV	Phoca spp	1
43	8/6/10	14:43	8/6/10 23:43	68.047	-167.054	2	fog	Phocoena spp	2
44	8/6/10	18:24	8/7/10 3:24	68.263	-167.165	2	OV	minke whale	1
45	8/6/10	19:41	8/7/10 4:41	68.201	-167.360	2	OV	Phoca spp	1
46	8/6/10	20:51	8/7/10 5:51	68.102	-167.664	2	OV	Dall's porpoise	2
47	8/6/10	22:05	8/7/10 7:05	68.023	-167.890	2	OV	Dall's porpoise	1
48	8/7/10	13:52	8/7/10 22:52	66.936	-170.987	3	fog	Humpback whale	3
49	8/7/10	14:24	8/7/10 23:24	66.920	-171.014	3	clearing	Humpback whale	1
50	8/7/10	14:35	8/7/10 23:35	66.904	-171.066	3	OV	Unid baleen	2
51	8/7/10	14:36	8/7/10 23:36	66.904	-171.066	3	OV	Bowhead	6
52	8/7/10	15:26	8/8/10 0:26	66.863	-171.166	4	OV	Bowhead	6
53	8/7/10	16:06	8/8/10 1:06	66.829	-171.254	4	OV	Polar bear	6
54	8/7/10	17:36	8/8/10 2:36	66.886	-171.365	4	OV	Bowhead	1
55	8/7/10	17:44	8/8/10 2:44	66.901	-171.375	4	OV	Walrus	120-150
56	8/7/10	17:59	8/8/10 2:59	66.928	-171.423	4	OV	Humpback whale	1
57	8/7/10	18:00	8/8/10 3:00	66.929	-171.423	4	OV	Polar bear	1
58	8/7/10	18:01	8/8/10 3:01	66.929	-171.423	4	OV	Bowhead	1
59	8/7/10	18:08	8/8/10 3:08	66.945	-171.438	4	fog	Humpback whale	1
60	8/7/10	18:54	8/8/10 3:54	66.996	-171.630	2	OV	Bowhead	1
61	8/7/10	19:23	8/8/10 4:23	66.985	-171.782	2	OV	Killer whale	2-3
62	8/8/10	9:40	8/8/10 18:40	67.580	-171.803	4	fog	Ring seal	1
63	8/8/10	11:38	8/8/10 20:38	67.397	-171.679	2	fog	Ring seal	1
64	8/8/10	13:16	8/8/10 22:16	67.090	-171.461	2	sun!	Humpback whale	2
65	8/8/10	13:55	8/8/10 22:55	66.959	-171.363	2	sun	Humpback whale	1

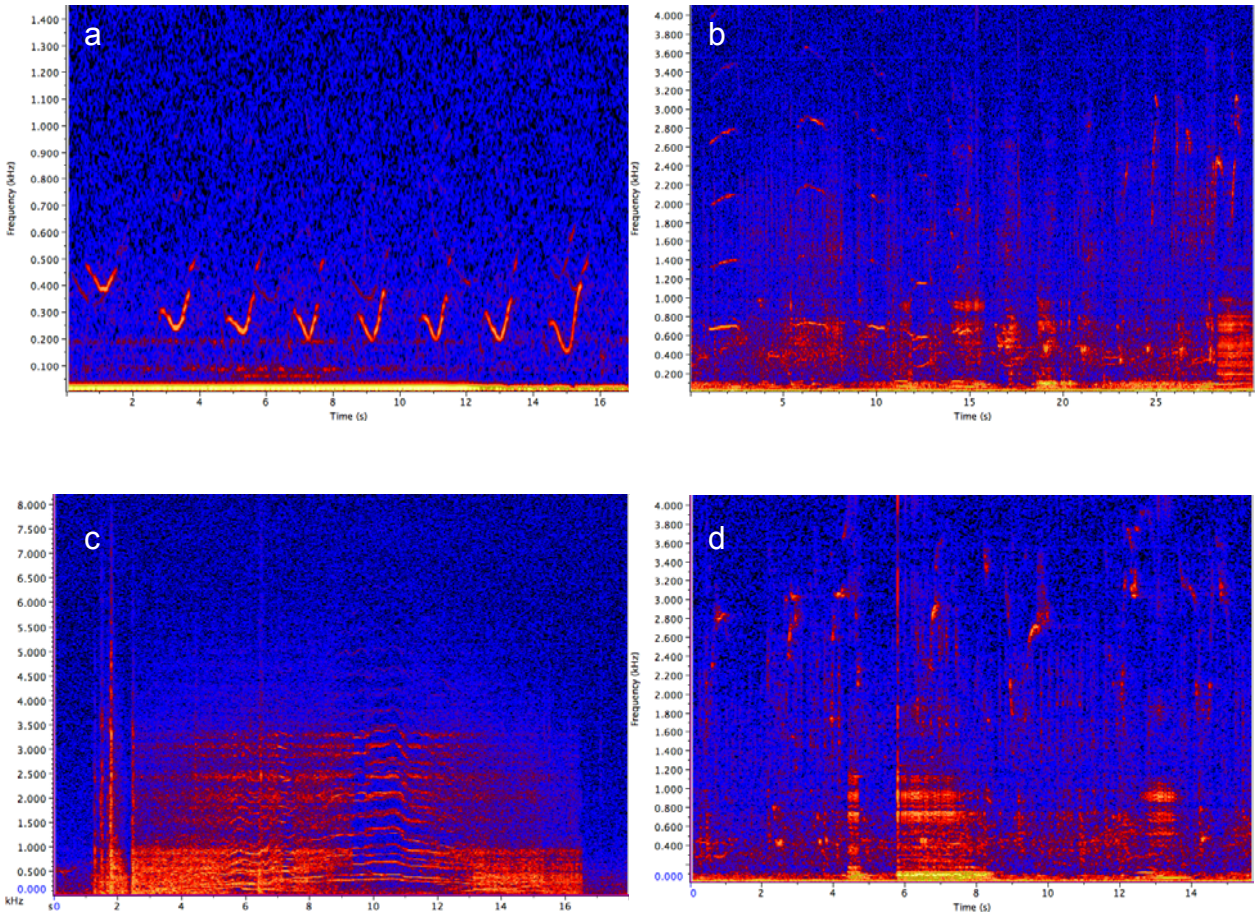
66	8/8/10	14:10	8/8/10 23:10	66.904	-171.331	2	sun	Unid baleen	1
67	8/8/10	14:52	8/8/10 23:52	66.773	-171.176	1	OV	Phoca spp	1
68	8/8/10	15:00	8/9/10 0:00	66.745	-171.107	1	OV	Unid baleen	1
69	8/8/10	15:28	8/9/10 0:28	66.679	-170.966	1	fog	Ring seal	1
70	8/8/10	15:38	8/9/10 0:38	66.655	-170.911	1	fog	Bearded seal	1
71	8/8/10	17:57	8/9/10 2:57	66.671	-170.559	2	clear	Humpback whale	1
72	8/8/10	20:10	8/9/10 5:10	66.777	-170.283	3	OV	Humpback whale	2
73	8/8/10	21:39	8/9/10 6:39	66.869	-170.047	4	OV	Unid baleen	1
74	8/9/10	7:20	8/9/10 16:20	66.644	-169.560	4	OV	Unid baleen	7
75	8/9/10	7:43	8/9/10 16:43	66.626	-169.608	4	OV	Gray whale	2
76	8/9/10	7:45	8/9/10 16:45	66.616	-169.629	4	OV	Unid baleen	2
77	8/9/10	8:00	8/9/10 17:00	66.600	-169.665	4	OV	Gray whale	4
78	8/9/10	8:09	8/9/10 17:09	66.598	-169.676	4	OV	Humpback whale	3
79	8/9/10	8:31	8/9/10 17:31	66.586	-169.712	4	OV	Humpback whale	2
80	8/9/10	8:32	8/9/10 17:32	66.586	-169.712	4	OV	Unid baleen	1
81	8/9/10	12:55	8/9/10 21:55	66.370	-170.260	4	light fog	Humpback whale	1
82	8/9/10	17:15	8/10/10 2:15	65.978	-169.646	3	OV	Unid baleen	1
83	8/9/10	20:53	8/10/10 5:53	65.893	-169.272	4	OV	Phoca spp	1

Table 3. Seabird species seen by day.

Species	8/1/10	8/2/10	8/3/10	8/4/10	8/5/10	8/6/10	8/7/10	8/8/10	8/9/10
Thick-billed murre	x	x	x	x	x	x	x	x	x
Common murre	x		x	x					x
Short-tailed shearwater	x	x	x	x	x	x	x	x	x
Tufted puffin	x	x	x	x	x	x	x	x	x
Horned puffin	x	x	x	x	x	x	x	x	x
Northern fulmar	x	x	x	x	x	x	x	x	x
Black legged kittiwake	x	x	x	x	x	x	x	x	x
Glaucous gull	x	x	x	x	x	x	x	x	x
Crested auklet		x	x	x	x		x	x	x
Least auklet		x	x	x	x		x		x
Parakeet auklet		x	x	x	x		x	x	x
Herring gull	x	x	x				x		x
Sabine's gull			x	x					x
Red-necked phalarope	x		x		x	x	x	x	x
Phalarope (unid)									
Pelagic cormorant		x	x	x	x		x	x	x
Unid jaeger			x				x		
Parasitic jaeger				x					x
Long-tailed jaeger						x			
Pomarine jaegar				x	x		x	x	x
Spectacled eider							x		
Steller's eider							x	x	

Marine mammal hydrophones

During RUSALCA 2010, 2 hydrophone packages were recovered and then redeployed at sites A2W (65.80N 168.798W) and A3 (66.327N 168.965W). Both instruments stopped recording earlier than expected due to battery drain. The instrument at A2W ran from 1 Sep 2009 to 16 Jan 2010 while the instrument at A3 lasted 6 weeks longer, from 1 Sep 2009 to 3 Mar 2010. Each instrument was on a duty cycle whereby the first 12 minutes of every hour were recorded at a sample rate of 16384 (10-8192 Hz bandwidth). No analysis of these data has occurred to date but a cursory exam of both instruments showed that the following species were recorded on each: humpback whale, bowhead whale, beluga whale, fin whale, walrus, and bearded seal. As analysis proceeds other species are likely to be detected including gray whale and ribbon seal.



Example spectrograms of a) bowhead whales; b) humpback whales and walrus; c) ice noise; d) beluga and walrus.

RUSALCA 2010 LEG 1 RUSSIAN DOCUMENTS FOR TRANSFER OF 2010 BERING STRAIT CTD DATA, TRANSFER OF 2009-2010 BERING STRAIT MOORING DATA (from A11-09, A12-09 and A13-09), AND FOR 2010 MOORING DEPLOYMENTS (A11-10, A12-10 and A13-10)

А К Т

передачи первичных океанографических данных, полученных в экспедиции «Русалка-2010» с использованием пробоотборной системы Rosette

«10» августа 2010 г. Берингов пролив

В Соответствии с Разрешением Министерства образования и науки Российской Федерации от 6 июля 2010 года № 26 в присутствии представителя заявителя морских научных исследований – ОАО «ГНИНГИ» – на борту НИС «Профессор Хромов» был произведен съем информации с компьютера, на который записывались данные приборов, установленных на пробоотборной системе Rosette.

Информация записана в папки/файлы:

1) Rusalca10_PreliminarySections
2) Rusalca10_RussiaCTD_rawfiles
3) Rusalca10_prelimprocessedfiles
4) Rusalca10_scannedCTDsamplelogs
5) Rusalca10_CTD_setup.doc
6) Rusalca10_event.xls

Данные скопированы на носители информации ОАО «ГНИНГИ» (CD) в четырех экземплярах. После копирования информации первичные данные удалены с жестких дисков компьютеров, использованных для съема и копирования данных.

Россия		США
Начальник экспедиции		Научный руководитель
В.Бахмутов		R.Woodgate
Представитель «Группы Альянс»		Представитель NOAA
А.Островский		K.Crane
Представитель ААНИИ		Представитель NOAA
Е.Бондарева		K.Wood

А К Т

передачи первичных данных измерений с приборов американских автономных буйковых станций А1-1-09, А1-2-09, А1-3-09, установленных в территориальном море Российской Федерации в Беринговом проливе в период с 28 августа 2009 г. по 2 августа 2010 г.

«10» августа 2010 г. Берингов пролив

В Соответствии с Разрешением Министерства образования и науки Российской Федерации от 6 июля 2010 года № 26 в присутствии представителя заявителя морских научных исследований – ОАО «ГНИНГИ» – на борту НИС «Профессор Хромов» был произведен съем информации с иностранных приборов, как указано ниже:

АБС А1-1-09

1) Акустический доплеровский профилограф течений ADCP «Sentinel» модель WHS300-I (с/н 11698).

2) Измеритель проводимости и температуры SBE-37SM MicroCAT (с/н 5361).

3) Датчик проводимости и температуры SBE-37 IM (с/н 7110).

4) Устройство записи данных ISCAT Logger (с/н 5).

АБС А1-2-09

1) Датчик нитратов Satlantic's ISUS (с/н 088).

2) CTD-зонд SBE-16plus, с/н 4639.

3) Акустический измеритель течения RCM9LW, с/н 636.

АБС А1-3-09

1) Измеритель течений Вектор-2, (с/н 50).

2) Измеритель проводимости-температуры SBE-37SMP MicroCAT (с/н 4835).

3) Акустический измеритель течения RCM9 (с/н 1173).

Информация с приборов записана в папки:

1) Rusalca10_adcprecover

2) Rusalca10_iscatrecover

3) Rusalca10_isusrecover

4) Rusalca10_rcmrecover

5) Rusalca10_sberecover

6) Rusalca10_aarirecover

Данные скопированы на носители информации ОАО «ГНИНГИ» (CD) в четырех экземплярах. После копирования информации первичные данные удалены из модулей памяти приборов и с компьютеров, использованных для съема и копирования данных.

Россия	США
Начальник экспедиции	Научный руководитель
В.Бахмутов	R.Woodgate
Представитель «Группы Альянс»	Представитель NOAA
А.Островский	K.Crane
Представитель ААНИИ	Представитель NOAA
Е.Бондарева	K.Wood

А К Т
постановки автономной буйковой станции АБС-1 (А1-1-10)

«4» августа 2010 г. Берингов пролив

В соответствии с Разрешением Министерства образования и науки Российской Федерации от 06 июля 2010 года № 26, заявитель морских научных исследований – ОАО «ГНИНГИ» – с борта НИС «Профессор Хромов» установил автономную буйковую станцию АБС-1 (А1-1-10) в следующей комплектации:

1) Акустический доплеровский профилограф течений ADCP «Sentinel» модель WHS300-I (серийный номер 1699BT);

2) Датчик проводимости-температуры «SBE-37SM MicroCAT», серийный номер 4600;

3) Система измерений проводимости, температуры, давления с возможностью уклонения от воздействия льда ISCAT, в которую входят датчик измерения проводимости-температуры SBE 37-IM (серийный номер 7621), индуктивное соединительное устройство SBE Inductive Cable Coupler, модем SBE ICC и записывающее устройство ISCAT Logger (серийный номер 25);

4) Гидроакустический ответчик-размыкатель модель 8242XS (серийный номер 31398).

Дата постановки (МСК): 4 августа 2010 года.
Время постановки (МСК): 03.05.
Координаты постановки: 65°54,001′ N 169°25,985′ W (WGS-84 - корма)
65°53,976′ N 169°25,989′ W (СК-42 - мостик)
Глубина в месте постановки: 52 м.
Высота станции над поверхностью дна: 34 м.

Приложение: схема постановки на 01 листе

Начальник экспедиции _____ В.Бахмутов

Представитель NOAA _____ K.Crane

Представитель компании «Группа Альянс» _____ А.Островский

Научный руководитель _____ R.Woodgate

Капитан судна _____ А.Дьяченко

А К Т
постановки автономной буйковой станции АБС-2 (А1-2-10)

«4» августа 2010 г. Берингов пролив

В соответствии с Разрешением Министерства образования и науки Российской Федерации от 06 июля 2010 года № 26, заявитель морских научных исследований – ОАО «ГНИНГИ» – с борта НИС «Профессор Хромов» установил автономную буйковую станцию АБС-2 (А1-2-10) в следующей комплектации:

1) Датчик нитратов Satlantic's ISUS (серийный номер 077);
2) CTD зонд SBE-16plus (серийный номер 4956);
3) Акустический измеритель течения RCM9 LW (серийный номер 108);
4) Измеритель уровня волнения и приливов SBE-26plus (серийный номер 1176);
5) Гидроакустический ответчик-размыкатель модель 8242XS в сдвоенном исполнении (серийные номера 31399 / 31401).

Дата постановки (МСК): 4 августа 2010 года.
Время постановки (МСК): 01.59.
Координаты постановки: 65°56,007′ N 169°36,990′ W (WGS-84 - корма)
65°55,984′ N 169°37,017′ W (СК-42 - мостик)
Глубина в месте постановки: 50 м.
Высота станции над поверхностью дна: 16 м.

Приложение: схема постановки на 01 листе

Начальник экспедиции _____ В.Бахмутов

Представитель NOAA _____ K.Crane

Представитель компании «Группа Альянс» _____ А.Островский

Научный руководитель _____ R.Woodgate

Капитан судна _____ А.Дьяченко

А К Т
постановки автономной буйковой станции АБС-3 (А1-3-10)

«4» августа 2010 г. Берингов пролив

В соответствии с Разрешением Министерства образования и науки Российской Федерации от 06 июля 2010 года № 26, заявитель морских научных исследований – ОАО «ГНИНГИ» – с борта НИС «Профессор Хромов» установил автономную буйковую станцию АБС-3 (А1-3-10) в следующей комплектации:

1) Измеритель течений «Вектор-2» (серийный номер 4);
2) Датчик проводимости-температуры «SBE-37SM MicroCAT» (серийный номер 3389);
3) Акустический измеритель течения RCM9LW (серийный номер 107);
4) Гидроакустический ответчик-размыкатель модель 8242XS (серийный номер 31396).

Дата постановки (МСК): 4 августа 2010 года.
Время постановки (МСК): 04.12.
Координаты постановки: 65°52,000′ N 169°16,987′ W (WGS-84 - корма)
65°51,973′ N 169°16,991′ W (СК-42 - мостик)
Глубина постановки: 50 м.
Высота станции над поверхностью дна: 16 м.

Приложение: схема постановки на 01 листе

Начальник экспедиции _____ В.Бахмутов

Представитель NOAA _____ K.Crane

Представитель компании «Группа Альянс» _____ А.Островский

Научный руководитель _____ R.Woodgate

Капитан судна _____ А.Дьяченко

RUSALCA 2010 Coordinates of region cleared for scientific activities

9. Координаты района морских научных исследований:

Географическая широта (в градусах, минутах и долях минут)		Географическая долгота (в градусах, минутах и долях минут)
Район №1		
$64^0$50,0' сев.	1	$172^0$06,0' зап.
$65^0$00,0' сев.	2	$172^0$06,0' зап.
$65^0$50,0' сев.	3	$169^0$55,0' зап.
$66^0$10,0' сев.	4	$169^0$55,0' зап.
$66^0$40,0' сев.	5	$171^0$00,0' зап.
$67^0$30,0' сев.	6	$173^0$20,0' зап.
$69^0$00,0' сев.	7	$167^0$00,0' зап.
$68^0$25,0' сев.	8	$166^0$50,0' зап.
$68^0$10,0' сев.	9	$166^0$50,0' зап.
$66^0$40,0' сев.	10	$168^0$06,0' зап.
$65^0$20,0' сев.	11	$168^0$06,0' зап.
$65^0$00,0' сев.	12	$167^0$04,0' зап.
$64^0$50,0' сев.	13	$167^0$04,0' зап.

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RUSALCA 2010 EVENT LOG

% date	GMTtime	type	#	Ops	Water	Latitude		Longitude		Station	
% yyyymmdd/	hhmm				Depth	Deg/Min		Deg/Min		Name	
%					(m)	(N)		(W)			
% Ops code 1=in 2=Out		% Type code 1=CTD		2=Vertical Net tows							
%		~ 5 nets taken during night of 1-2nd August 2010									
20100804	2017	1	1	1	56	65	47.040	168	33.58	A2	Prod cast
20100804	2031	1	1	2	56	65	47.280	168	32.99	A2	
20100804	2116	1	2	1	56	65	48.160	168	31.16	A2	Prod cast
20100804	2123	1	2	2	56	65	48.320	168	30.84	A2	
20100804	2131	2	1	1	56	65	48.510	168	30.51	A2	
20100804	2138	2	1	2	56	65	48.680	168	30.21	A2	
20100805	0037	1	3	1	26	65	35.063	168	7.18	BS24	
20100805	0045	1	3	2	26	65	35.224	168	7.314	BS24	
20100805	0107	1	4	1	33	65	36.238	168	10.404	BS23	
20100805	0117	1	4	2	33	65	36.511	168	10.937	BS23	
20100805	0150	1	5	1	34	65	37.830	168	11.075	BS22	
20100805	0157	1	5	2	34	65	38.110	168	11.153	BS22	
20100805	0200	2	2	1	34	65	38.313	168	10.132	BS22	
20100805	0206	2	2	2	34	65	38.858	168	6.369	BS22	
20100805	0244	1	6	1	42	65	38.610	168	14.99	BS21	
20100805	0254	1	6	2	42	65	39.000	168	15.45	BS21	
20100805	0331	1	7	1	49	65	39.422	168	19.242	BS20	
20100805	0344	1	7	2	49	65	40.452	168	17.234	BS20	
20100805	0415	1	8	1	52	65	40.534	168	23.562	BS19	
20100805	0430	1	8	2	52	65	40.855	168	23.815	BS19	"Coms lost on upcast, cast in 2 files (,b)"
20100805	0515	1	9	1	54	65	41.704	168	26.81	BS18	Rebatteried before cast. ~1nm N of BS18
20100805	0530	1	9	2	54	65	42.086	168	27.017	BS18	
20100805	0556	1	10	1	55	65	42.139	168	31.121	BS17	
20100805	0612	1	10	2	55	65	42.417	168	31.247	BS17	
20100805	0652	1	11	1	52	65	43.550	168	35.633	BS16	Arrived on site: 6:33
20100805	0706	1	11	2	52	65	43.862	168	35.608	BS16	

20100805	0737	1	12	1	52	65	44.271	168	39.761	BS15	
20100805	0756	1	12	2	52	65	44.550	168	40.04	BS15	
20100805	0819	1	13	1	53	65	45.220	168	43.14	BS14	
20100805	0835	1	13	2	53	65	45.576	168	43.318	BS14	
20100805	0905	1	14	1	53	65	46.290	168	47.43	BS13	
20100805	0917	1	14	2	53	65	46.580	168	47.267	BS13	
20100805	0947	1	15	1	46	65	47.278	168	51.607	BS12	
20100805	0958	1	15	2	46	65	47.296	168	51.884	BS12	
20100805	1030	1	16	1	47	65	48.409	168	55.837	BS11	End of US section
20100805	1042	1	16	2	47	65	48.670	168	55.856	BS11	
20100805	1114	1	17	1	38	65	49.492	169	0.012	BS10	
20100805	1125	1	17	2	38	65	49.493	169	0.108	BS10	
20100805	1153	1	18	1	46	65	50.568	169	4.283	BS9	
20100805	1204	1	18	2	46	65	50.818	169	4.266	BS9	
20100805	1233	1	19	1	48	65	51.750	169	8.366	BS8	
20100805	1244	1	19	2	48	65	51.850	169	7.979	BS8	
20100805	1249	2	3	1	48	65	51.907	169	7.779	BS8	
20100805	1257	2	3	2	48	65	51.986	169	7.509	BS8	
20100805	1331	1	20	1	49	65	52.794	169	12.802	BS7	
20100805	1345	1	20	2	49	65	52.932	169	12.964	BS7	
20100805	1413	1	21	1	50	65	53.584	169	16.742	BS6	
20100805	1424	1	21	2	50	65	53.708	169	16.861	BS6	
20100805	1452	1	22	1	51	65	54.601	169	21.102	BS5	
20100805	1503	1	22	2	51	65	54.774	169	21.235	BS5	
20100805	1531	1	23	1	53	65	55.686	169	25.471	BS4	
20100805	1543	1	23	2	53	65	55.849	169	25.475	BS4	
20100805	1611	1	24	1	51	65	56.730	169	29.91	BS3	
20100805	1623	1	24	2	51	65	56.860	169	29.58	BS3	
20100805	1626	2	4	1	51	65	56.860	169	29.58	BS3	
20100805	1629	2	4	2	51	65	56.860	169	29.58	BS3	
20100805	1700	1	25	1	51	65	57.761	169	34.242	BS2	
20100805	1710	1	25	2	51	65	57.852	169	34.192	BS2	
20100805	1730	1	26	1	50	65	58.234	169	36.401	BS1.5	
20100805	1738	1	26	2	50	65	58.324	169	36.341	BS1.5	
20100805	1811	1	27	1	49	65	58.858	169	38.494	BS1	
20100805	1820	1	27	2	49	65	59.011	169	38.226	BS1	
20100805	1826	2	5	1	49	65	59.123	169	38.013	BS1	

20100805	1829	2	5	2	49	65	59.170	169	37.923	BS1	
20100805	1859	1	28	1	49	65	59.335	169	40.692	BS.5	End of BS
20100805	1908	1	28	2	49	65	59.447	169	40.472	BS.5	
20100805	1953	1	29	1	50	65	56.116	169	37.009	A1-2	Nut cast for A1-2 mooring ISUS
20100805	2003	1	29	2	50	65	56.204	169	36.944	A1-2	
20100805	2012	1	30	1	50	65	56.300	169	36.868	a1-2	prod 1 of 2
20100805	2019	1	30	2	50	65	56.370	169	36.806	A1-2	
20100805	2117	1	31	1	50	65	56.129	169	36.949	A1-2	prod 2 of 2
20100805	2125	1	31	2	50	65	56.176	169	36.886	A1-2	
20100805	2248	1	32	1	38	66	7.199	169	35.54	AL1	Start of AL line
20100805	2255	1	32	2	38	66	7.266	169	35.652	AL1	
20100805	2300	2	6	1	38	66	7.281	169	35.683	AL1	
20100805	2303	2	6	2	38	66	7.311	169	35.755	AL1	
20100805	2326	1	33	1	49	66	7.733	169	33.787	AL1.5	
20100805	2334	1	33	2	49	66	7.756	169	33.733	AL1.5	
20100805	2353	1	34	1	50	66	8.348	169	32.141	AL2	
20100806	0001	1	34	2	50	66	8.442	169	32.021	AL2	Sampling completed at 00:06
20100806	0024	1	35	1	52	66	9.446	169	28.824	AL3	"Bottle 4 reported misfired, 5 fired as well"
20100806	0033	1	35	2	52	66	9.560	169	28.788	AL3	Sampling completed at 00:40
20100806	0100	1	36	1	55	66	10.564	169	25.406	AL4	
20100806	0109	1	36	2	55	66	10.666	169	25.394	AL4	Sampling completed at 01:14
20100806	0132	1	37	1	55	66	11.786	169	21.847	AL5	
20100806	0142	1	37	2	55	66	11.934	169	21.763	AL5	Sampling completed at 01:48
20100806	0211	1	38	1	56	66	12.842	169	18.546	AL6	
20100806	0221	1	38	2	56	66	12.887	169	18.547	AL6	Sampling completed 02:26
20100806	0248	1	39	1	57	66	13.999	169	15.184	AL7	
20100806	0258	1	39	2	57	66	14.083	169	15.211	AL7	Sampling completed
20100806	0325	1	40	1	58	66	15.169	169	11.736	AL8	
20100806	0333	1	40	2	58	66	15.292	169	11.869	AL8	Sampling completed 03:39
20100806	0358	1	41	1	58	66	16.286	169	8.287	AL9	
20100806	0409	1	41	2	58	66	16.409	169	8.324	AL9	Sampling completed 4:15
20100806	0436	1	42	1	57	66	17.490	169	4.861	AL10	
20100806	0446	1	42	2	57	66	17.682	169	4.95	AL10	Sampling completed 453
20100806	0512	1	43	1	58	66	18.595	169	1.444	AL11	Last Russian Station on AL line
20100806	0524	1	43	2	58	66	18.679	169	1.594	AL11	Scan length error on CTD at 8 m

20100806	0551	1	44	1	57	66	19.734	168	58.082	AL12	Back in US waters
20100806	0602	1	44	2	57	66	19.872	168	58.216	AL12	Sampling completed 06:10
20100806	0632	1	45	1	57	66	20.407	168	53.774	AL13	
20100806	0642	1	45	2	57	66	20.448	168	53.992	AL13	Sampling completed 648
20100806	0712	1	46	1	56	66	21.139	168	49.43	AL14	
20100806	0722	1	46	2	56	66	21.205	168	49.498	AL14	Sampling completed 727
20100806	0751	1	47	1	49	66	21.851	168	45.102	AL15	
20100806	0800	1	47	2	49	66	21.888	168	45.168	AL15	
20100806	0830	1	48	1	59	66	22.567	168	40.82	AL16	
20100806	0841	1	48	2	59	66	22.692	168	40.735	AL16	
20100806	0905	1	49	1	57	66	23.246	168	36.408	AL17	
20100806	0915	1	49	2	57	66	23.273	168	36.366	AL17	
20100806	0946	1	50	1	54	66	23.692	168	32.155	AL18	"Comms lost on up. 4 btls 1sthalf cast, 8 btls *b.hex"
20100806	0959	1	50	2	54	66	23.989	168	32.227	AL18	
20100806	1038	1	51	1	55	66	24.786	168	28.2	AL19	Rebatteried before this cast
20100806	1046	1	51	2	55	66	24.844	168	28.417	AL19	
20100806	1115	1	52	1	54	66	25.361	168	23.479	AL20	
20100806	1124	1	52	2	54	66	25.392	168	23.492	AL20	
20100806	1151	1	53	1	49	66	26.105	168	19.199	AL21	
20100806	1201	1	53	2	49	66	26.183	168	19.237	AL21	
20100806	1227	1	54	1	43	66	26.786	168	14.845	AL22	
20100806	1236	1	54	2	43	66	26.807	168	14.808	AL22	
20100806	1302	1	55	1	36	66	27.475	168	10.591	AL23	
20100806	1310	1	55	2	36	66	27.500	168	10.51	AL23	
20100806	1333	1	56	1	29	66	28.181	168	6.202	AL24	Last station on AL line
20100806	1341	1	56	2	29	66	28.181	168	5.945	AL24	
20100807	0022	1	57	1	28	68	19.966	166	52.4	CS19	Start of CS line near point hope
20100807	0030	1	57	2	28	68	20.023	166	52.585	CS19	Sampling completed 0038
20100807	0104	1	58	1	35	68	18.958	166	57.619	CS18	
20100807	0111	1	58	2	35	68	18.949	166	57.898	CS18	Sampling completed 117
20100807	0140	1	59	1	39	68	17.984	167	2.804	CS17	
20100807	0148	1	59	2	39	68	17.999	167	2.806	CS17	Sampling completed 155
20100807	0155	2	7	1	39	68	18.010	167	2.807	CS17	
20100807	0201	2	7	2	39	68	18.020	167	2.809	CS17	
20100807	0240	1	60	1	46	68	15.000	167	12.158	CS16	
20100807	0246	1	60	2	46	68	14.971	167	12.293	CS16	

29100807	0333	1	61	1	48	68	12.083	167	21.347	CS15	
20100807	0344	1	61	2	48	68	12.084	167	21.649	CS15	Sampling completed 351
20100807	0454	1	62	1	53	68	6.136	167	39.872	CS14	
20100807	0507	1	62	2	53	68	6.059	167	40.099	CS14	Sampling completed 0518
20100807	0509	2	8	1	53	68	6.043	167	40.175	CS14	
20100807	0515	2	8	2	53	68	6.013	167	40.33	CS14	
20100807	0632	1	63	1	56	67	59.335	167	59.365	CS13	Lots of birds observed here
20100807	0641	1	63	2	56	67	59.306	167	59.461	CS13	Sampling completed 0649
20100807	0800	1	64	1	57	67	52.535	168	18.814	CS12	
20100807	0809	1	64	2	57	67	52.518	168	18.898	CS12	
20100807	0813	2	9	1	57	67	52.510	168	18.933	CS12	
20100807	0818	2	9	2	57	67	52.496	168	18.985	CS12	
20100807	0945	1	65	1	51	67	45.300	168	39.884	CS11	Last US station on CS Line
20100807	0953	1	65	2	51	67	45.286	168	39.884	CS11	
20100807	1123	1	66	1	51	67	38.083	169	0.976	CS10	First Russian station on CS Line
20100807	1133	1	66	2	51	67	38.094	169	0.994	CS10	
20100807	1137	2	10	1	51	67	38.106	169	1.02	CS10	
20100807	1142	2	10	2	51	67	38.122	169	1.054	CS10	
20100807	1302	1	67	1	52	67	32.027	169	18.364	CS9	
20100807	1311	1	67	2	52	67	32.009	169	18.364	CS9	
20100807	1424	1	68	1	51	67	25.910	169	35.784	CS8	
20100807	1434	1	68	2	51	67	25.831	169	35.828	CS8	
20100807	1438	2	11	1	51	67	25.802	169	35.842	CS8	
20100807	1443	2	11	2	51	67	25.780	169	35.844	CS8	
20100807	1609	1	69	1	50	67	18.676	169	56.424	CS7	
20100807	1617	1	69	2	50	67	18.658	169	56.495	CS7	
20100807	1738	1	70	1	49	67	11.358	170	17.173	CS6	
20100807	1746	1	70	2	49	67	11.286	170	17.299	CS6	
20100807	1750	2	12	1	49	67	11.240	170	17.365	CS6	
20100807	1754	2	12	2	49	67	11.217	170	17.389	CS6	
20100807	1815	1	71	1	49	67	11.060	170	17.542	CS6	prod 1 of 2
20100807	1820	1	71	2	49	67	11.020	170	17.612	CS6	
20100807	1849	1	72	1	49	67	10.781	170	17.79	CS6	prod 2 of 2
20100807	1856	1	72	2	49	67	10.732	170	17.846	CS6	
20100807	2019	1	73	1	46	67	3.719	170	38.189	CS5	
20100807	2029	1	73	2	46	67	3.566	170	38.302	CS5	
20100807	2156	1	74	1	43	66	56.029	170	59.371	CS4	

20100807	2206	1	74	2	43	66	55.877	170	59.347	CS4	
20100807	2210	2	13	1	43	66	55.792	170	59.338	CS4	
20100807	2212	2	13	2	43	66	55.751	170	59.331	CS4	
20100807	2243	1	75	1	42	66	53.903	171	4.609	CS3	
20100807	2252	1	75	2	42	66	53.737	171	4.597	CS3	
20100807	2223	1	76	1	39	66	51.822	171	9.981	CS2	
20100807	2230	1	76	2	39	66	51.671	171	9.918	CS2	
20100808	0004	1	77	1	36	66	49.751	171	15.24	CS1	
20100808	0014	1	77	2	36	66	49.566	171	15.068	CS1	
20100808	0016	2	14	1	36	66	49.397	171	14.953	CS1	
20100808	0021	2	14	2	36	66	49.325	171	14.915	CS1	
20100808	0044	1	78	1	35	66	48.700	171	18.206	CS0.5	
20100808	0051	1	78	2	35	66	48.556	171	18.144	CS0.5	End of CS line. Sampling completed 0057
20100808	0340	1	79	1	32	66	58.932	171	47.79	CN1	Start of CN line
20100808	0347	1	79	2	32	66	58.700	171	47.371	CN1	Sampling completed 351
20100808	0348	2	15	1	32	66	58.712	171	47.168	CN1	
20100808	0352	2	15	2	32	66	58.634	171	46.951	CN1	
20100808	0422	1	80	1	36	67	0.006	171	47.776	CN1.5	
20100808	0430	1	80	2	36	66	59.987	171	47.278	CN1.5	
20100808	0453	1	81	1	38	67	0.992	171	47.824	CN2	
20100808	0501	1	81	2	38	67	0.965	171	47.456	CN2	drifted about 0.4 nautical miles off station to the east
20100808	0533	1	82	1	41	67	2.748	171	47.886	CN3	
20100808	0541	1	82	2	41	67	2.656	171	47.442	CN3	Sampling completed 546 . Drifted ~ 0.3 miles to E
20100808	0615	1	83	1	41	67	4.580	171	47.836	CN4	
20100808	0623	1	83	2	41	67	4.518	171	47.335	CN4	Drifted 0.3 miles to ESE. Sampling completed 628
20100808	0655	1	84	1	42	67	6.410	171	47.76	CN5	Bottle 7 failed to fire
20100808	0705	1	84	2	42	67	6.360	171	47.04	CN5	Drifted 0.425 miles to the east.
20100808	0738	1	85	1	45	67	8.216	171	47.818	CN6	
20100808	0746	1	85	2	45	67	8.173	171	47.406	CN6	Drifted 0.25 nautical miles to the east
20100808	0814	1	86	1	46	67	10.818	171	47.848	CN7	
20100808	0822	1	86	2	46	67	9.997	171	47.502	CN7	
20100808	0851	1	87	1	47	67	11.810	171	47.856	CN8	"No fire reported on 1 & 6. Btl 1 open, Btl 6 fired"
20100808	0900	1	87	2	47	67	11.797	171	47.412	CN8	
20100808	0933	1	88	1	47	67	13.541	171	47.848	CN9	All btl fires OK
20100808	0942	1	88	2	47	67	13.412	171	47.609	CN9	
20100808	0946	2	16	1	47	67	13.361	171	47.46	CN9	

20100808	0950	2	16	2	47	67	13.328	171	47.324	CN9	
20100808	1025	1	89	1	48	67	15.413	171	47.891	CN10	
20100808	1032	1	89	2	48	67	15.433	171	47.695	CN10	
20100808	1100	1	90	1	49	67	17.201	171	47.926	CN11	
20100808	1109	1	90	2	49	67	17.224	171	47.742	CN11	
20100808	1135	1	91	1	49	67	18.990	171	47.934	CN12	
20100808	1143	1	91	2	49	67	18.994	171	47.73	CN12	
20100808	1208	1	92	1	51	67	20.801	171	47.986	CN13	
20100808	1215	1	92	2	51	67	20.806	171	47.857	CN13	
20100808	1245	1	93	1	51	67	22.573	171	47.972	CN14	
20100808	1254	1	93	2	51	67	22.576	171	47.766	CN14	
20100808	1322	1	94	1	51	67	24.379	171	47.98	CN15	
20100808	1332	1	94	2	51	67	24.382	171	47.753	CN15	
20100808	1357	1	95	1	50	67	26.191	171	47.977	CN16	
20100808	1405	1	95	2	50	67	26.210	171	47.836	CN16	
20100808	1431	1	96	1	49	67	27.990	171	48.001	CN17	
20100808	1440	1	96	2	49	67	28.001	171	47.846	CN17	
20100808	1505	1	97	1	47	67	29.788	171	48.024	CN18	
20100808	1517	1	97	2	47	67	29.773	171	47.886	CN18	
20100808	1520	2	17	1	47	67	29.754	171	47.826	CN18	
20100808	1525	2	17	2	47	67	29.739	171	47.709	CN18	
20100808	1550	1	98	1	48	67	31.585	171	48.023	CN19	
20100808	1559	1	98	2	48	67	31.546	171	47.96	CN19	
20100808	1633	1	99	1	48	67	33.421	171	47.988	CN20	
20100808	1640	1	99	2	48	67	33.335	171	48	CN20	
20100808	1709	1	100	1	47	67	35.231	171	48.007	CN21	
20100808	1715	1	100	2	47	67	35.164	171	47.999	CN21	
20100808	1720	2	18	1	47	67	35.075	171	48.019	CN21	
20100808	1723	2	18	2	47	67	35.035	171	48.033	CN21	
20100808	1743	1	101	1	47	67	34.741	171	48.178	CN21	prod 1 of 2
20100808	1750	1	101	2	47	67	34.632	171	48.232	CN21	
20100808	1819	1	102	1	47	67	34.299	171	48.499	CN21	prod 2 of 2
20100808	1826	1	102	2	47	67	34.135	171	48.58	CN21	
20100809	10	1	103	1	36	66	35.466	170	46.218	CV1	
20100809	18	1	103	2	36	66	35.302	170	45.954	CV1	Drifted 0.275 nautical miles to the southeast
20100809	47	1	104	1	40	66	36.977	170	42.431	CV1.5	

20100809	55	1	104	2	40	66	36.907	170	42.173	CV1.5	drifted .208 nm directly east
20100809	124	1	105	1	44	66	38.263	170	38.971	CV2	
20100809	131	1	105	2	44	66	38.203	170	38.755	CV2	drifted .190 nm southeast
20100809	214	1	106	1	46	66	41.071	170	31.676	CV3	
20100809	225	1	106	2	46	66	40.960	170	31.352	CV3	drifted .20 nm southeast
20100809	308	1	107	1	47	66	43.882	170	24.427	CV4	
20100809	317	1	107	2	47	66	43.850	170	24.199	CV4	
20100809	400	1	108	1	46	66	46.685	170	17.12	CV5	"5 and 6 did not confirm fire, 7 worked. "
20100809	408	1	108	2	46	66	46.615	170	17.03	CV5	CTD Batteries Replaced
20100809	453	1	109	1	46	66	49.447	170	9.779	CV6	
20100809	501	1	109	2	46	66	49.361	170	9.474	CV6	
20100809	545	1	110	1	47	66	52.267	170	2.407	CV7	
20100809	554	1	110	2	47	66	52.175	170	2.083	CV7	
20100809	637	1	111	1	48	66	55.040	169	55.19	CV8	
20100809	648	1	111	2	48	66	54.907	169	55.007	CV8	
20100809	730	1	112	1	49	66	57.865	169	47.93	CV9	"Bottle 4 did not confirm fire, bottle five worked "
20100809	740	1	112	2	49	66	57.748	169	47.839	CV9	
20100809	827	1	113	1	50	67	0.677	169	40.662	CV10	Btl 4 OK
20100809	836	1	113	2	50	67	0.600	169	40.553	CV10	
20100809	918	1	114	1	51	67	3.443	169	33.34	CV11	
20100809	927	1	114	2	51	67	3.365	169	33.264	CV11	
20100809	1149	1	115	1	48	66	49.717	169	4.312	CX11	Btl 6 did not confirm fire and did not trip
20100809	1159	1	115	2	48	66	49.706	169	4.236	CX11	
20100809	1247	1	116	1	49	66	46.942	169	11.534	CX10	
20100809	1256	1	116	2	49	66	46.927	169	11.572	CX10	
20100809	1337	1	117	1	49	66	44.142	169	18.851	CX9	
20100809	1346	1	117	2	49	66	44.200	169	19.177	CX9	
20100809	1429	1	118	1	49	66	41.401	169	25.936	CX8	No fire reports for btl 1-3. B1-3open
20100809	1439	1	118	2	49	66	41.437	169	26.297	CX8	
20100809	1518	1	119	1	49	66	38.628	169	33.17	CX7	
20100809	1526	1	119	2	49	66	38.656	169	33.527	CX7	
20100809	1608	1	120	1	50	66	35.876	169	40.32	CX6	
20100809	1615	1	120	2	50	66	35.894	169	40.609	CX6	
20100809	1658	1	121	1	58	66	33.083	169	47.635	CX5	
20100809	1708	1	121	2	58	66	33.075	169	48.136	CX5	bottles 2 and 3 did not fire
20100809	1750	1	122	1	51	66	30.277	169	54.787	CX4	

20100809	1758	1	122	2	51	66	30.242	169	55.074	CX4	
20100809	1836	1	123	1	49	66	27.532	170	1.907	CX3	"bottles 4,6,8,9,10 Computer rebooted "
20100809	1844	1	123	2	49	66	27.478	170	2.153	CX3	
20100809	1923	1	124	1	46	66	24.748	170	8.976	CX2	
20100809	1929	1	124	2	46	66	24.624	170	8.989	CX2	
20100809	2000	1	125	1	43	66	23.258	170	12.516	CX1.5	
20100809	2008	1	125	2	43	66	22.974	170	12.199	CX1.5	
20100809	2039	1	126	1	40	66	22.068	170	16.094	CX1	
20100809	2046	1	126	2	40	66	21.930	170	16.121	CX1	
20100810	31	1	127	1	49	65	59.233	169	40.889	BS0.5	Drfited 0.4 nm to WSW. Nobeltec says 2.2 kts
20100810	39	1	127	2	49	65	59.092	169	41.48	BS0.5	
20100810	111	1	128	1	49	65	58.734	169	38.698	BS1	
20100810	119	1	128	2	49	65	58.547	169	38.887	BS1	Drifted 0.3 miles SW, nobeltec says 1.5 knots
20100810	139	1	129	1	51	65	58.254	169	36.419	BS1.5	Bottle 6 did not confirm fire, used bottle 7 instead.
20100810	147	1	129	2	51	65	58.045	169	36.629	BS1.5	Drifted 0.3 nm to the southwest
20100810	210	1	130	1	51	65	57.672	169	34.283	BS2	
20100810	218	1	130	2	51	65	57.446	169	34.522	BS2	Drifted 0.35 nm to the southwest, nobeltec says 2 kn
20100810	254	1	131	1	52	65	56.650	169	29.966	BS3	Deviated for dead floating walrus
20100810	301	1	131	2	52	65	56.513	169	29.902	BS3	
20100810	329	1	132	1	52	65	55.742	169	25.432	BS4	
20100810	337	1	132	2	52	65	55.714	169	25.109	BS4	Drift direction reversed, now moving to the north
20100810	406	1	133	1	50	65	54.576	169	20.933	BS5	Bottles 6 and 7 did not confirm fire, 8 worked
20100810	417	1	133	2	50	65	54.534	169	20.497	BS5	
20100810	448	1	134	1	50	65	53.568	169	16.556	BS6	
20100810	458	1	134	2	50	65	53.538	169	16.099	BS6	B 6&7 fired in unison. Comms error at surface. "
20100810	525	1	135	1	48	65	52.801	169	12.611	BS7	Re batteried before this cast.
20100810	534	1	135	2	48	65	52.768	169	12.184	BS7	6 &7 did not fire. 8 worked. 7 was mechanical error
20100810	604	1	136	1	48	65	51.668	169	8.244	BS8	
20100810	614	1	136	2	48	65	51.667	169	7.727	BS8	6,7 and 8 did not fire. 9 worked.
20100810	645	1	137	1	46	65	50.472	169	3.848	BS9	
20100810	653	1	137	2	46	65	50.497	169	3.33	BS9	poured warm water over CTD, 6 fired ok this time